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Editorial

BROADCASTING.

Of all modern scientific inventions radio broadcasting stands unrivalled as an instrument for propaganda and education. In all the progressive countries of the world it has made considerable headway during recent years. In most of the larger European states, in the United States of America, in Australia and in Canada, the number of registered listeners now exceeds five percent of the population, whole in Great Britain and Northern Ireland it is 15 per cent. The position of India in this respect is not, however, a very enviable one. For a population of 350 millions the number of registered listeners is less than 12,000 or about 0.003 per cent. The number of receivers per 1,000 of the population in India is only 0.033, while Denmark has 160, Great Britain 152·4, the United States of America 135, Australia 104, Canada 552 and Japan 217. The number of transmitters in India is only 2 while Great Britain has 14, U. S. A. 585, Australia 61, Canada 67 and Japan 26. These figures will show that we in India have not touched the fringe of the problem yet.

Radio broadcasting was introduced into India about eight years ago, first as a private commercial monopoly, and was subsequently taken up by the Government. Nevertheless the progress has been very slow. India has to cover considerable ground before she can come to the level of the civilized

countries of the world in this respect. What earnestness and enthusiasm can achieve in this direction can be seen from the example of Japan where, although broadcasting was introduced only ten years ago, there are at present 28·2 listeners per 1,000 inhabitants. It is, however, very encouraging to note that at the present time there are signs of an awakening in this respect everywhere in India. The Government of India has appointed a Director of Broadcasting to control the working of the whole service, and some of the provincial Governments have already started experimental schemes, though on a small scale.

Radio as a means of recreation and amusement, now finds a place in many households and it is being adopted for educational and propaganda purposes to an ever-increasing extent. The important role which broadcasting is likely to play in India in rural development can never be overstated. One of the most serious problems connected with the development of rural areas in India is the difficulty of reaching the millions who live in thousands of isolated and remote villages. It is impossible for the propagandists, however numerous they be, to reach all the three-quarter of a million villages in India and be available to the cultivators when they want them most. Radio eliminates this difficulty by making it possible to talk simultaneously to millions of people living far apart, from a central station, both for their edification and recreation. In all progressive countries radio is now an established method of rural and agricultural propaganda and it is an absolutely indispensable weapon if we wish to accelerate the progress of rural development in India. Where-ever it was tried, broadcasting was a great success. In Peshawar the programmes of the Rural Broadcasting Service are said to be very popular amongst the Frontier Folks and numerous requests for the extension of the service to other villages in Peshawar and other districts of the Frontier have already been.

made by certain members of the Frontier Council. So, also, the broadcasting service undertaken by the Allahabad Agricultural Institute as part of their rural reconstruction programme was found to be of great assistance in rousing the interest of the villagers in the solution of their problems. The total capital outlay for developing broadcasting on an all-India basis has been estimated at about 113 crores of rupees. Enormous though the investment appears to be, it would repay the nation in the shape of an educated populace and a revitalized countryside.

Original Articles.

COTTON PROSPECTS ON THE COLLEGE FARM

BY J. C. McDOUGALL, M. A., B. SC.,

The monsoon commenced lightly on the 9th June. and during the next 10 days only about 1½ inches fell. The ground was therefore virtually still dry when it was decided so start sowing on the 17th, in the hope that the rain would set in properly in time to make the sowing successful. But on the 18th evening the outlook appeared doubtful and sowing was suspended. A good shower was received on the 23rd with prospects of more to follow, and operations were resumed on the 24th. Heavy rain fell on the 25th, 26th and 29th, and it was with some difficulty that sowing was completed on the 2nd July. The area sown on the 17th and 18th (about 7 acres) took a long time to germinate and came up irregularly, but even so it established a lead over the rest of the area which it has maintained throughout the season. The later sowings were marred by heavy showers. It was observed that when heavy rain fell within 24 hours of sowing germination was unsatisfactory, but that if 48 or more hours elapsed without heavy rain the crop came up well. Dibbling was undertaken vigorously between the 2nd and 7th July and this proved very successful, the plants emerging in five to six days. The total rainfall in June was just over 10 inches-- ample in volume but coming in too heavy towards the end of the month for optimum working conditions. By the middle of July only another 4 inches had fallen, fairly well distributed, and conditions were reasonably satisfactory. The second half of July was, however, distinctly unfavourable. Rain fell almost every day, culminating in a 5 inch fall on the 29th followed by 3 inches on the 30th.

As a result, low-lying undrained areas went under and have never recovered. Growth was severely checked even in the high-lying and drained areas, and the position in general was becoming critical. Weeds were flourishing and the cotton was at a standstill.

Observation of the records of Akola and Nagpur farms have shown, however, that the month of August is the really critical time as regards the vegetative growth of cotton. This has been brought out very clearly and forcibly in a series of charts prepared for the Akola farm by the Economic Botanist. These charts show quite definitely that in all years when the outturn at Akola was good the August rainfall was light, and that given an August of this type and no heavy precipitation in late September or early October, a satisfactory crop can be counted on with reasonable certainty. These deductions are fully substantiated by close observation of the College Farm crop over a series of years. Although, therefore, the position at the end of July gave cause for anxiety there was reason to hope that conditions might still come back to normal. That hope did not extend to low-lying undrained areas, but such areas on this year's cotton area are fortunately not extensive.

August was a pleasing contrast to the second half of July. The total rainfall for the month was 8.3 inches, more than half of which fell on the 23rd and 24th. There was thus ample opportunity for weeding and hoeing and the crop began to recover very rapidly, particularly after a top-dressing with artificials took effect. An interesting comparision was in evidence of the comparative effects of nitrate of soda and sulphate of ammonia. The effect of nitrate of soda was apparent in 3 or 4 days but sulphate of ammonia took much longer to act- 12 to 14 days. Very favourable weather continued into early September and, at the time of writing, (17th September) the crop is well grown and healthy, though perhaps a trifle late. But its ultimate fate is not yet decided. During the past week, the weather has not been quite so favourable; sharp thunder shower have been frequent, and though no damage appears to have been done, so far, one would prefer to see more definite signs of the monsoon dying off. The crop is at the beginning of the delicate reproductive stage when much damage may be caused by intermittent heavy rain and bright sunshine, bringing about excessive shedding of buds and bolls. At the moment, however, the prospects have not deteriorated. A count made on the 16th September showed that only 20 buds and bolls had dropped per 100 plants, and this is quite a normal occurrence, however favourable the weather conditions. Given satisfac-

tory weather from now onwards, that is, a gentle receding of the monsoon without violent outbursts of rain, a satisfactory crop is more or less assured. It is not likely to come up to last year's record of a *khandi* per acre, but the 1934 rainfall on and in the vicinity of the farm was singularly favourable throughout until the last four days of September, when there was a fall of 5 inches which reduced the outturn by anything up to 25 %. It is the possibility of a similar catastrophe intervening at any time during the remainder of September or the first week of October that precludes any precise estimation of the crop at this stage. To attempt to do so, in any season, before September is out is merely to indulge in a gamble with Nature.

A NOTE ON THE MARKETING OF FIELD PRODUCES.*

BY N. K. DAS, L. Ag. (Hons.)

The whole subject of the marketing of field produces is too comprehensive to admit of a detailed discussion in a paper like this. Only a few important points are therefore discussed in brief.

One result of the development of communication facilities in the world has been to create competition among agricultural producers of distant regions. Potato growers of the Khasi Hills, Madras and Burma are competitors in the Calcutta market; linseed growers of India and the Argentine are competitors in the United Kingdom market; and it is possible to multiply instances like these to any number. The inevitable consequence of this competition is that those commodities which are produced and marketed in an inefficient manner are always at a disadvantage and may sometimes be even ousted from the market. The real problem which agricultural people in every country have nowadays to solve is therefore not merely one of either efficient production or of efficient marketing but of combining both. In our enthusiasm for the development of one side we cannot afford to forget or neglect the other.

It is not within the scope of this note to deal with the methods of efficient production. But two important features of production which help efficient marketing may be stated here. These are as follows:—

(1) As far as possible production should be in bulk and in more or less compact centres. Unless this be the case the produce cannot be economically handled nor can a regular trade be easily built up. In the

* (Paper read at the sixth session of the Surma Valley Agricultural Officers' Conference held at Sylhet in March, 1935).

market, the price of a commodity is governed by the law of supply and demand and any increase in the cost of handling therefore means a corresponding decrease in the price which the producer would get.

(2) Production should conform to the requirements of the market in regard to quality, variety and fancy points. It is difficult to find an extensive market for any commodity to which consumers are not accustomed unless of course it be a speciality. It is also to be borne in mind that the demand for ordinary field produces is generally inelastic and cannot therefore be increased to any appreciable extent by advertisement.

Improved marketing means increased return to the producer for his goods. This may also lead in some cases to the same goods becoming cheaper to the consumer—a fact which may appear paradoxical at first sight but is nevertheless true, as will be evident from the following discussion.

The position of the cultivator as a producer has an important bearing on the marketing of field produces. The average cultivator is a man with limited financial resources. He sells his crops soon after harvest; sometimes even before harvest. He requires money for maintaining his family, carrying on agricultural operations, paying his creditors and such other purposes. Moreover he cannot always provide suitable storage for his produce which is often bulky and sometimes perishable. All these causes prevent him from holding his crops for any considerable length of time against a probable rise in price. Again for lack of credit, knowledge, ability, time and labour he is generally unable to undertake the marketing of his field produce to the best advantage. Even if these causes did not exist the small quantities in which field crops are produced by individual cultivators would often make such a proposition impracticable. These circumstances have brought into existence between the producer and the consumer a number of intermediaries who are called middlemen and who help in the marketing of produce in various ways. It may be stated at the outset that middlemen render distinct services to society by financing producers, collecting goods from wide areas and dispersing them in consuming centres. There are various types of middlemen going by different names and conducting different market operations. Some of them take title to the goods they deal in and bear all risks consequent upon it. They are known as merchants. There are again others who merely help in the transfer of title to the goods from one hand to another without taking any risk of

ownership and are paid for their services by the buyer or the seller. The are called functional middlemen. This latter class is represented by commission agents, brokers, auctioneers, railway companies, banks, etc.

In view of the services rendered by middlemen they cannot be necessarily regarded as undesirable elements in society. There are probably many who think that by the mere elimination of independent middlemen through the co-operative activities of producers, marketing conditions can be invariably improved. This, however, is far from the truth; for, the duties of middlemen cannot be done away with. If existing middlemen are eliminated some other agencies will have to take up their duties. Any effort on the part of producers to market their own goods without securing either increased economy or greater efficiency is practically meaningless. Because, this can lead to the mere integration of marketing with production but not to any financial gain for producers. In this connexion it should be borne in mind that specialisation is as important in marketing as in production. In deciding whether certain steps in marketing should or should not be taken by producers themselves the question of possible disadvantages which might arise from the loss of specialised services of independent middlemen cannot be overlooked. The market risk which may arise from the fluctuation of prices and the deterioration of the stored commodity has also to be considered.

In the absence of any independent marketing agencies in a particular area, producers are always justified in creating marketing agencies of their own.

A real necessity for the elimination of independent middlemen arises under certain circumstances, namely,

(1) when their number is unnecessarily large;

(2) when the services rendered by them can be performed more efficiently or at a lower cost;

(3) when they indulge in dishonest practices;

(4) and when producers cannot deal with them as free men.

When these conditions exist the difference between the producer's price and the cost to the consumer becomes very wide. By creating marketing agencies of producers it is possible in such cases to effect considerable economies in the various marketing operations and thus increase the producer's price while the cost to the consumer remains the same or is even reduced.

The existence of unsatisfactory conditions in India in regard to the services of middlemen is no doubt responsible for the present cry in the country for the better marketing of agricultural produce. Before, however, any development work can be intelligently taken up in regard to any particular commodity it will be necessary first of all to gain accurate and detailed information as to the conditions under which that commodity is being marketed at present.

When existing conditions are found to justify the elimination of independent marketing agencies one of the most important preliminary steps to secure middlemens' profits for producers will presumably be to organise the latter into marketing associations. These may in turn combine to form district and provincial associations as necessary. It has been indicated above that, from the view-point of producers, the control of marketing means securing cheaper or better services for the sale of their goods in suitable centres and at suitable times as compared with those rendered by existing middlemen. Under comprehensive unified control it may also be possible for producers to prevent prices from going too low by the restriction of the area under a given crop or by destroying part of the produce. This aspect of market control contemplates the federation of producers' associations over wide areas. It is not proposed, nor would it be wise without a certain amount of preliminary investigation, to give details of the type of producers' associations which should be formed. In America, there are various types of growers' associations for the marketing of farm produce. There are again others which are formed under ordinary corporation laws. The relation of the members with the co-operative associations is also not the same in all cases. Some of the associations buy for cash from their members (as well as from non-members), while others, particularly those dealing with perishable commodities, adopt the method of pooling. "By pooling is meant averaging the returns received for products sold during a certain period, or for certain shipments, so that each grower having products of the same grade receives the same price. This method of operation protects the individual member from loss because of unfavourable market conditions of a temporary nature."**

A special advantage which may accrue to producers who form themselves into marketing associations is that of standardising the products handled according to the requirements of the market. Proper grading fetches better price for high quality from consumers, particularly in the

** O. B. Jesness quoted in "Principles of Marketing" by F. E. Clark.

case of perishable goods, and this in turn encourages better farming. Middlemen in India rarely seem to do full justice to growers of high grade crops.

The question of the organisation of marketing associations naturally leads to the question of their finance. Funds will be required by such associations for (1) the collection of goods, (2) maintenance and insurance of godowns, (3) processing, grading and packing, (4) transporting goods to the market and (5) management. If they are to buy the members' produce for cash they will require large amounts, particularly during certain seasons. How can money be found for all these purposes ?

The members might subscribe the capital required. But considering the limited means of our cultivators it does not seem probable that the whole of the requisite capital can be raised in this way. Even if it were possible it might not be quite desirable. Because, while the capital of an association might be utilised in full or even taxed during certain seasons of the year, much of it would be likely to remain idle during other times on account of the seasonal character of agricultural production. This money could then be used elsewhere by the members for more productive purposes. To raise at least a part of the capital by borrowing may, therefore, be often desirable. When there is no use for the borrowed money it can be repaid to the creditor. If a marketing association needs to borrow money it must have credit in the money market. An association of cultivators with limited liability cannot have much credit. It will therefore, in all probability, be necessary to organise producers' associations with unlimited liability. But even with unlimited liability it may not be always possible for a marketing association to borrow all the money it requires without collateral security. In foreign countries where organised marketing is much developed borrowing on the receipts of warehouses is in vogue. Perhaps a similar method could be resorted to by producers' associations in this country also, at least by those dealing in non-perishable goods.

It may be incidentally stated here that in typical American co-operative marketing associations "no profits above interest at about the market rate are paid to shareholders on the money they invest." The profits, if any are divided among the members on the basis of the quantity of goods sold by each of them through the association. The dividend thus given encourages loyalty to the association and is called patronage dividend. This is also frequently given to non-members selling their goods through the association. Again, irrespective of the number of

shares held by individual members, each of them is entitled to only one vote. Sometimes the number of shares which a member may buy is limited. These provisions act as a brake on those who merely seek profit on their investment but are not interested in the common benefit of the members.

The appointment of marketing staffs by the Central and various Provincial Governments in India marks the active interest which they have begun to take in the development of efficient marketing methods for agricultural produce. Without in any way anticipating the extent and nature of government help which will be available to producers' associations for marketing, it may be stated that Government may help such organisations in various ways, such as by providing inspection and technical help, supplying market news, giving loans and subsidies, etc. It should however be remembered that inspite of all extraneous help the co-operative spirit remains the main factor in any co-operative movement. The producer must be loyal to his organisation through which he must sell all his produce and not play into the hands of the middleman who, by offering higher prices, may try to wean him away. This temptation is bound to come when the organisation of producers becomes really effective. If, however, it succeeds in causing the organisation to fall to pieces, the middleman will again be the master of the situation and offers of tempting prices will no longer be made.

This note should be closed with a word regarding the present position of the co-operative movement in India. According to figures ralating to the year 1932, which are the latest figures available to the writer at the time of writing this note, there are about 94,000 agricultural co-operative societies in this country of which only about 4,100 are non-credit. Societies for the marketing of agricultural produce must be much less in number. It is thus clear that though the Co-operative movement in India is serving over two crores of people—a number which no other movement in the country can boast of—it has done very little up to this time in developing organised marketing of agricultural produces. "Stopping short of marketing," says a writer, "has been the sin of co-operation in India." In fact the three aspects of co-operation, namely, co-operative credit, co-operative production and co-operative marketing should be developed side by side. It is only then that the position of the Indian cultivator as a producer can be really strengthened.

A SURVEY OF THE DIFFERENT VARIETIES OF COTTON GROWN IN BURHANPUR TAHSIL (NIMAR)*

By V. G. Vaidya

Introduction.—Burhanpur tahsil has of late years developed a tendency towards increasing the area under *Buri* cotton. The rise in area has been on a progressive scale and almost phenomenal. This cotton was introduced by the Agriculture Department in 1922, but it did not then spread rapidly. It is only during the last two or three years that it has gained popularity among cultivators and supplemented the local cottons.

The causes that have led to this naturally form a fitting subject for enquiry and this enquiry into the various varieties of cotton growing in Burhanpur tahsil with their economic value was, therefore, taken up.

For convenience the subject matter is divided into two parts:—

(i) Agricultural survey.

(ii) Economic survey.

The agricultural part deals with the soil, climate and the history of cotton with special reference to different varieties grown in the tahsil. The rapidity with which the different varieties succeeded one another within a comparatively short duration of time offers an interesting item of study in this branch.

The development of road communications and its effect on the trade of cotton is traced in the second part. The appreciation by the market of better stapled cotton after the introduction of verum pooling is discussed. A case is made for co-operative marketing of stapled cotton like *buri* to ensure proper valuation.

The survey would be incomplete if the history of the recent developments in cotton growing of the tahsil, either through Government agency or by private attempts, was not given and their effect on the economic value of the cottons at present grown was not traced. Some account of this aspect of the subjects is therefore given.

Agricultural Survey:—(i) General description of Burhanpur Tahsil.—To have a general idea of the Tahsil the following description from the Nimar District Gazetteer will be useful.

" Burhanpur Tahsil is the southern tahsil of the Nimar district lying between 21 degrees-5' and 21 degrees 37' North and 75 degrees 57' and 76 degrees 48' East. It is bordered by Khandwa and Harsud tahsil, Indore

* Thesis submitted for the B. Ag. Examination 1935.

state. Khandesh and Berar. Its area is 1138 square miles or 27% of the district. The tahsil comprises a section of the Tapti Valley and the hills which border it on either side. Both are branches of the Satpura range but they differ in character, for the southern hills are steep and narrow from while the northern range is a mass of low elevation about 11 miles wide which one or two peaks like Asirgarh 2204 feet high, rise conspicuously. The length of the Tapti Valley is about 44 miles and its extreme width about 35 miles. The whole portion of the valley is a fully occupied and highly cultivated area. This forms the Burhanpur and Shahpur Tract. East of Burhanpur is known as Majrod tract a large part of which has recently been reclaimed by ryotwari settlement. The main bed of alluvial soil of the Tapti ceases, however, a few miles east of Burhanpur and the soil of the upper valley is much less fertile. It has no great growth of trees but it bears much grass. In the centre of the valley within the cultivated area of the Majrod tract is the Samardeo hill which breaks the level of the plain and for a while deflects the Tapti river towards the north. The whole north of the Tahsil is occupied by low hills and forest and the only extensive stretch of cultivation is concentrated in the plain between the two ranges of the Satpuras. The whole tahsil except the extreme north is within the water shed of the Tapti and its principal tributaries the utaoli and Mona. The streams from the northern hills carry to the river the first rush of rain but the remainder collects in the subsoil at the foot of the hills and is trapped by the series of linked wells which yield the splendid water supply of Burhanpur town."

(ii) **Survey of soils of the Tahsil.**—There are two types of soils in the Tahsil. One is the alluvial soil found round about Burhanpur, and the other the black cotton soil formed from trap rock which occupies all the rest of the Culturable area. The long strip of land lying on both sides of the Burhanpur-Dharni road and the alluvial valley of the Tapti round Burhanpur form nearly all the culturable land in the Tahsil. The soil has been classified for assessment purposes as follows:—

Gata I and II are low lying moist black soils of considerable depth which usually produces two crops without irrigation. *Thawar* I and II signify level land of good deep heavy black soil.

Mal I, II and III are lands lying high or on a slope. The colouration varies from black to brown. The soils are well drained.

For cotton cultivation *Thawar* II, *Mal* I and II are suitable lands, *Mal* I representing the black cotton soil of Berar.

The distribution of the soils in the three revenue circles of the Tahsil is given below.

Shahpur Circle-*Mal* I and *Thawar* II are predominant, being about 85 % of the total culturable land. The area under light soils like *Mal* III and *Khardi* is very small.

Burhanpur Circle- has a larger area of *Mal* I and II class of soils, while *Thawar* falls comparatively into the back ground.

Khaknar Circle has a rich soil of *Thawar* I and II and *Mal* I class. This tract till very recently was under forest. It was brought under the plough by some enterprising farmers who settled there after 1900 A. D. From Burhanpur up to Khaknar the land belongs to the *mal* class. Beyond that, it starts getting heavier till we reach Dedtalai where it is so heavy that only rabi crops are grown.

From the above description of the distribution of the soils, it can be seen that the Burhanpur tract can endure a moderately heavy rainfall while the other two tracts are so heavy that high rainfall in certain years causes the cotton crop to suffer from waterlogging.

Climate—(a) *Rainfall.*—The rainfall of Khandwa district is the lightest of any district in the Central Provinces, but is excellently adapted to the *khariff* crops of millet and cotton which are principally grown. The average rainfall for Burhanpur for the 39 years ending 1905-06 was 32″. During this period of 39 years the annual amount recorded for the district was above 40″ in 9 years and less than 22″ in 4 years. A fall of 22″ is sufficient, if properly distributed, to give a fairly good harvest of *khariff* crops on retentive soils. The monthly averages for 33 years ending 1899-1900 were June 6″, July 9″, August 7½″, September 6½″, October less than 1½″. During the remaining seven months only 1½″ are received. On the whole, the distribution of rain fall is more capricious in Burhanpur than in Khandwa as observed from the rainfall charts. A glance at the rainfall records of Burhanpur from 1906-1933, however, will reveal that from 1907-1928 the rainfall was below average for 13 years, normal for 4 years, and above average for 4 years only out of 27 years. This shows that there was a trend towards decrease in rainfall from 1907-1928—the average for these years being 26. 8″. Circumstances, however, have changed within the last 6 years when the rainfall was never below 32″, except in the year 1929-30, and went as high as 48″ during the year 1931-32. There is no other rainfall recording station elsewhere, in the tahsil, but from the experience of the cultivators, supported by the situation as well, it is deduced that the Khaknar tract

receives nearly 20% more rainfall than Shahpur and Burhanpur circles.

If we examine the distribution of rainfall from 1906-1928 we find that there were very few September showers and in many years, rain ceased after the middle of September. Due to increasing rainfall from 1928 to date we get October showers. The increase in rainfall and the variation in the distribution that has recently occurred have affected the cotton cultivation and made it possible to grow certain better stapled varieties.

The following table gives the general distribution of rainfall during the growth of *khariff* crops of the tahsil for the last 7 years and also the average distribution of the rainfall from 1906 to 1928.

TABLE I.

Year.	Total rain-fall.	June.	July.	August.	September.	October.	November.	December.
1928—1929 ...	41.42	...	...	...	...	...	...	...
1929—1930 ...	19.97	6.93	7.23	1.79	3.80	...	0.10	...
1930—1931 ...	39.31	3.08	8.68	5.94	20.44	0.51	1.74	...
1931—1932 ...	48.07	6.37	9.14	11.67	6.81	11.16	...	...
1932—1933 ...	32.30	3.90	14.28	5.10	4.44	1.94	...	0.58
1933—1934 ...	33.58	6.39	7.82	7.28	9.77	1.72	...	...
1934—1935 ...	44.23	2.18	11.98	9.54	13.70	5.08	...	...
Average rainfall from 1906—1928.	20.80	5.80	8.90	6.70	4.70	0. 6	...	...

(b). **Temperature.**—Nimar is somewhat cooler than Nagpur in the hot weather and has practically the same temperature during the rains. On the whole, the climate is drier. The lower portions of the Tapti Valley are much hotter than the higher plateau of the tahsil. The extensive tracts of forest lying to the west in the course of the prevailing winds keep the atmosphere cool and clear during breaks in the rains, and the monsoon season is pleasanter than in most districts of the Central Provinces.

The average mean, maximum and minimum temperatures are as follows :—

TABLE II.

Month.	Maximum.	Minimum.	Mean.
January ...	84.0 degrees	52.0 degrees	67.5 degrees
May ...	106.5 „	81.0 „	93.0 „
July ...	87.5 „	75.0 „	80.5 „

Statistics and general remarks.—Of the whole area, about 890 square miles or 78% were included in the Government forest. Of the village area of 455 square miles a proportion of 67% was occupied for cultivation in 1905-1906 as against 58% at the last settlement of 1895-99. In the Burhanpur circle 74% available area, and in Khaknar circle only 23%, was occupied in the year 1905-1906. This shows that there was a lot of culturable waste in the Khaknar circle. The area under cultivation however has been increasing especially in Khaknar circle. The cropped area in that circle has risen from 23% to 69% during the last 28 years. There is a rapid growth in the acreage brought under cultivation because of the settlement of new ryotwari villages on land taken from Government forest. Some amount of unoccupied land still remains in the tahsil and the area of Government Forest available for Agricultural Settlement is not yet exhausted.

The area under cultivation has since 1895 been on the increase as indicated by the table below :—

TABLE III.

Year.	Net cropped area.	Area under cotton.	Area under Juar.
1895—99 ...	95,944	33,063	27,106
1906—07 ...	154,956	70,979	45,751
1912—13 ...	165,542	69,758	53,771
1922—23 ...	181,019	84,155	57,804
1925—26 ...	211,189	112,036	50,723
1927—28 ...	206,385	96,008	69,748
1929—30 ...	204,519	98,972	61,218
1931—32 ...	203,669	87,111	68,598
1933—34 ...	199,746	74,171	74.438

This table reveals the fact that there has been, on the whole, a tendency to recover more and more land from the forest and put it under the plough. It also shows that most of the area brought under cultivation upto the year 1925-26 has been occupied by cotton and *juar*, and there is still a tendency towards increasing the area under *juar* while the area under cotton has steadily been on the decline since the year 1925-26.

The decline in the area under cotton has probably been the result of the declining prices offered for cotton in the market. A survey of the prices for cotton in the market since the year 1921-22 shows a rise from Rs. 28/5/- in the year 1921-22 to Rs. 57/5/- per maund of lint in 1923-24. Thereafter it started to decline showing a regular downward tendency until it touched the lowest figure of Rs. 15/- per maund of lint in 1931-32. Juar showed a steady rate, occasionally rising by small amounts up till 1931-32, in which year it fell as low as Rs. 2/ per maund, as against the usual rate of Rs. 4/- per maund.

The declining prices, and the adverse climatic conditions with heavy and late rainfall in recent years, are probably mainly responsible for the decrease in the total area under cotton. The area under juar has been steadily rising from the year 1895 up to date, and since the year 1925-26 the area taken from cotton has more are less been added to *juar*. This is perhaps due to the fact that the climate did not so adversely affect the *juar*, and due also to the prices of juar remaining steady. Further, the decline in the rate of cotton reduced the purchasing power of the cultivators, necessitating the home production of fodder *Juar* as a crop which supplies both grain and fodder, and in times of low purchasing power affords a decent means of subsistence to the cultivators.

Importance of cotton in the tashil.—From table No. III it will be seen that the area under cotton which was 29% of the total area under cultivation reached a maximum limit of 55.6% by a steady increase from the year 1895 96 to 1925-26. Though in recent years, due to economic and weather conditions, it has touched the low figure of 32%, as in the year 1932-33, it offers a promise that with re-establishment of suitable conditions it may again resume its own importance. It may, therefore, be concluded that cotton is one of the most important crops of the tashil. It is therefore, of interest to find out what different varieties at present are economic and what are likely to be of more economic importance in the future.

Standards for valuation and comparison of different varieties of cotton grown in the tashil.—Before tracing the history of cotton grown in

Burhanpur Tahsil, a comparative statement of different varieties is essential for ready reference.

The economic value of cotton is viewed from two angles of vision by the consumer and the producer. The consumer or the manufacturer values cotton for different qualities of fibre such as length, strength, fineness and uniformity of staple; colour and cleanness determining the grade. Any one of the factors showing an improvement raises the value of the kapas though the other factors remain unchanged.

The cultivator will necessarily choose that variety which gives the highest net profit per acre. From his point of view, therefore, the value of a variety depends on (i) hardiness of the plant, (ii) yield per acre of seed cotton, (iii) ginning percentage and (iv) market price of the variety.

The different varieties grown in the Tahsil are :—

(i) Local *Jari* called Nimari or Deshi.

(ii) *Roseum.*

(iii) *Verum.*

(iv) *Buri.*

These varieties, along with other improved strains introduced in the Tahsil are compared in the following tables to give a clear idea about them, both from the commercial and agricultural points of view. From the commercial point of view *Buri* is taken as the standard, and from the agricultural point of view *Roseum* is taken as the standard for assessing other varieties. (See page 18).

Historical sketch of cotton growing in Burhanpur Tahsil.—The whole history of cotton cultivation in the tahsil can be divided into four more or less distinct periods. The first period traces back to 1868 and extends upto 1906. The important features of this period are the attempts at introduction of Hinganghat cotton and establishment of '*hata vilayati*' or '*jari*' cotton in the tahsil at the expense of the old deshi cotton.

The next period extends from 1906 to 1922, in which *jari* cotton was exclusively grown. In the earlier part, from 1906 to 1911, finer cottons like *Verum* and *Malvensis* predominated in the *jari* mixture, while in the later part coarser varieties like *Roseum* dominated.

The third period ranges from 1922 to 1931. In these years the short stapled *Roseum* prevailed almost throughout the tahsil.

The last period extending from 1931 onwards is notable for the rapid increase in the area under long stapled cotton. For the first two years from 1931 to 1933 *Verum* and *Buri* both spread equally and for the last two years *Buri* has come into prominence.

TABLE IV.

Table showing comparison of samples of different varieties of cotton from the commercial point of view.

No.	Name of variety.	Staple.					Grade.		Price, Broach basis. Rs. 190/- on 31.4. 1934	Highest warp count.	Feel.
		Length of staple in inches.	Strength.	Blow room waste P. C.	Fineness.	Uniformity.	Colour.	Cleanness.			
1	Local *Jari* ...	$\frac{1}{2}$—$\frac{5}{8}$	Fair	14	Rough	Irregular	Milky white	Clean	172/-	15	Medium.
2	*Roseum* .	$\frac{1}{2}$	do.	12	do.	do.	White	Very clean	122/-	8	Coarse.
3	*Verum* 262 ...	$\frac{3}{4}$—$\frac{7}{8}$	do.	12	Extra superfine	Regular	Bright white	Fairly clean	245/-	26	Good-bodied.
4	Local *Buri* ...	$\frac{7}{8}$—1	Weak	15-18	Fairly good	Irregular	Creamy white	Clean	230/-	35	Good, soft.
5	Late *Verum* (Akola) ..	$\frac{3}{4}$—$\frac{7}{8}$	Fair	12	Extra superfine	Regular	Bright white	Fairly clean	241/-	28	Good-bodied.
6	*Buri* 84 ..	$\frac{7}{8}$—1	Weak	15-16	Fine	Regular	Creamy white	Clean	271/-	44	Good-silky.
7	*Buri* Ak. Sp. ...	$\frac{7}{8}$—1	Weak	15-16	Fair	Irregular	do.	do.	240/-	44	Good, smooth.
8	*Bani* ...	1—$\frac{1}{8}$	Fair	12	Extra superfine	Regular	Very white	Fairly clean	265/-	44	Good-bodied.

N. B.—The figures in the above table have been taken from the analysis done by the Director, Technological Laboratory Matunga.

Table showing comparison of different varieties from Agricultural point of view.

No.	Name of variety.	Yield of kapas in pounds. yield of Jari 320 lbs.	Ginning percentage.	Value of lint per Khandi.	Probable value of crop per acre. Rs. A. P.	Hardiness of plant.	Proportion of picking per unit of efficient labour in a unite of time.	Normal date of ripening or first picking.	Remarks.
1	Local *Jari* ...	320	34.0	172/-	29 1 0	Hardy, does well in all conditions.	70	1st week of November	Ease in picking depends upon pe centage of *roseum* and *Verum*.
2	*Roseum* ...	400	38.0	122/-	28 14 0	Hardiest, stands different weathers, susceptible to wilt.	85	do.	Loculi open wide and lint does nc adhere tenaciously to loculi, s picking easy.
3	*Verum* 262 ...	280	31.3	245/-	31 10 0	Susceptible to *rhizoctonia*, wilt resistant, susceptible to small changes in soil and climatic conditions.	60	4th week of October	Lint adheres to loculi and s picking is not clean and easy a in *roseum*.
4	*Buri* local ...	300	31.5	230/-	32 9 0	Susceptible to leafblight, immune to wilt, successful in rich soil, cool climate with late season.	100	1st week of December	Loculi open wide and lint doe not adhere tenaciously, so pick ing easy.
5	Late *Verum* (Akola)	270	29.0	241/-	28 4 0	Same as *Verum*, suited to tracts with late rains.	50	2nd week of November	Same as *Verum*.
6	*Buri* 84 ...	310	30.0	270/-	36 12 0	As local *Buri*.	100	1st week of December	Same as *Buri* local.
7	*Buri* Ak. Special ...	310	30.0	240/-	33 4 0	do.	100	do.	do.
8	*Bani* ...	250	25.0	252/-	24 1 0	Very exacting in soil and climatic conditions.	35	2nd week of November	Picking difficult.

The detailed history of each period, with special reference to the variety that dominated in that period, is given in the following page :—

(i) **Period from 1868 to 1906.**—In 1868, attempts were made by the District Agricultural Association to introduce Hinganghat cotton. It did not grow successfully, and so attempts at introduction were withheld for the time being. '*Kata Vilayati** or *jari*' of the present day was introduced in 1892 by some Khandwa banias who brought the seed from Jalgaon in Berar. Bacause of the good yield and higher ginning percentage, *jari* cotton gained so much favour with the cultivators that within ten or fifteen years it occupied almost all the area that was under the old *deshi* cotton which had a very low ginning percentage. *Deshi* cotton was then relegated to poor land or remote portions of the tahsil where it was locally made into homespun cloth. Another attempt at introduction of Hinganghat cotton made in the year 1906 met with the same fate as the earlier one, because the verdict of the cultivators was in favour of *Jari* as being more easily picked, quicker to ripen and generally more productive. (See table IV). In the same year experiments were also conducted with Upland Georgian, which gave promising results. A reference will be made to it in due course.

(ii) **Period from 1906 to 1922.**—During this period local *jari* was exclusively grown and therefore, a detailed study of this cotton is of great necessity.

TABLE V.

No.	Botanical Name.	Characteristics.
1	*Gossypium neglectum Roseum* ...	Narrow lobed, white flower.
2	" " *Cutchicum* ...	Broad lobed, white flower.
3	" " *Verum* ...	Narrow lobed, yellow flower.
4	" " *Malvensis* ...	Broad lobed, yellow fllower.
5	*Gossypium indicum* (Bani) ...	" "
6	*Gossypium hirsutum* (*Dharwari* and *Buri*) ...	Broad lobed palmate pinkish-white flower.

* The "Cotton cultivation and Trade in Central Provinces and Berar" by L. E. P. Gaskin. Agriculturai Journal of India Volume II Part II April 1907. Page 170 to 192.

The local *jari* cotton is a mixture of three species *Gossypium neglectum*, *Gossypiuw indicum* and *Gossypium hirsutum*. Prominent among these are the four different varieties of *Gossypium neglectum* named by Professor Gammie as follows:—

The proportion of these varieties* in the mixture was determined separately by Mr. Fletcher D. D. A. Bombay presidency in 1904 and Dr. Cloustion** in C. P. in 1911. Mr. Fletcher, for the purposes of analysing botanically some of the commercial growths of cotton, obtained through the courtesy of the Bombay Chamber of Commerce and Messrs. Ralli Brothers, seeds of the growths from several places in the Deccan tract, while Dr Cloustion got it from the District Agricultural Association, Nimar. They counted the plants of different varieties in the mixture. Owing to the inability of the fieldmen to distinguish between *Bani* and *Malvensis* these varieties were counted as one.

Dr. Cloustion has remarked that the character of the mixture was found to vary greatly in different parts of the province. In the Tapti

TABLE VI.

Name under which seed was received.	P. C. Analysis of plants.					Remarks.
	Roseum.	Cutchicum.	Verum.	Malvensis.	Gossypium Hirsutum.	
Khandwa fair stable ...	11.4	20.3	11.4	53.1	3.8	In 1904 Fletcher.
Nimar average good staple.	0	5.0	55.0	38.0	2.0	In 1911 Clouston.
Amraoti ...	33	24	22	19	2	do.
do. ...	59	8	16	16	1	do.
Ellichpur ...	81	6	5	3	5	In 1929-30 by Asst. Burhanpur,
Burhanpur ...	43	2	40	5	10	In 1934 by the writer.

* "The Improvement of the Cottons of the Bombay Presidency by F, Fletcher, M. A. B. Sc., Agricultural Journal of India Vol. I Oct. 1906 Page 371.

** "Cotton cultivation in C, P. and Berar studied from on economic aspect" by Dr. Clouston. Agricultural journal of India Vol. VI Part IV Page 357.

Valley and Njmar the finer types, viz., *Verm* and *Malvensis*, predominated. In quality, the lint of this mixture was probably very similar to that of *jari* or *Oomra* grown 50 years ago. In the south including all Berar, where cotton cultivation was more advanced and the cultivators more intelligent, the coarser but more productive type, viz., *Roseum* was found to be in excess. This mixture is commonly known in Berar as *Jari*, *Katavilayati* or *Varadi*. Its origin is doubtful. It is said to have been introduced from Khandesh into Berar and from there into the tahsil in 1892.

Fletcher's analysis of the Nimar cottons show nearly the same tendency in the mixture. It can, therefore, be safely concluded that the spread of the coarser variety *roseum* was much slower in the tahsil than in Berar. Its spread, however, increased after 1911-12 and it rapidly replaced the finer cotton because *jari* was not grown for adulteration purposes, but had a market of its own with a very profitable export trade to the continent of Europe and Japan, for admixture with wool and for spinning low counts. It was grown from choice and not necessity. The cultivators were not dependent on ginning factories for their seed, but in the majority of cases kept their own seed. In doing so they chose the whitest, largest and coarsest bolls at the time of the second picking, and discarded the others. Under this system of selection, *Verum* and *Malvensis* the finer varieties were deliberately thrown away and the coarser *Roesum* retained. This accounts for the important change that occurred in the cotton supply for nearly 10 years from 1912-1922. Periodic analyses of the mixture were not made by anybody and so the exact percentage of different varieties cannot be given during this period. This much can be said, that about 1922 *Roseum* constituted nearly 70 % of the mixture.

(iii) **The Roseum era. (1922-1931).**—The increasing tendency of the cultivators to retain *roseum* and discard the finer types finally led to the cultivation of pure *Roseum*, which gives both the largest yield of *kapas* and the highest ginning percentage of all the varieties (see table No. IV). Though it is a coarse variety, it fetched a small premium over *jari* due to its clean and white lint. It thus paid cultivators to grow pure *Roseum* in place of *jari* mixture. Pure *Roseum* seed was first introduced in the tahsil in 1914-1915. The Agricultural Department undertook *roseum* seed distribution in the tahsil from the year 1918, by which time the varietal experiments on Akola farm had proved the superiority of *roseum* over all other varieties as regards yield and market value. The demand for seed rose so considerably in the succeeding years that it was difficult to meet. This inability to supply seed checked its rapid spread for some years.

The following table shows the distribution of *roseum* seed in the Tahsil by seed unions.

TABLE VII.

Year.	Total area under cotton.	No. of seed unions.	Seed distributed in Mds. of 80 lbs.	Area according to seed distribution. Seed rate 13 lbs. per acre.
1914—15	...	introduced.		
1918—19	...	8	370	2220
1919—20	...	...	476	2856
1920—21	...	...	527	3162
1921—22	66495	...	715	4590
1922—23	84155	...	1560	9360
1923—24	92113	40	2039	12234
1924—25	111120	44	3258	19548
1925—26	112056	51	4124	24744
1926—27	102076	65	5568	33408
1927—28	96008.	62	4658	27948
1928—29	102896	70	5732	34392
1929—30	98972	86	11887	71322
1930—31	92829	...	5760	34560
1931—32	87111	40	3348	20088

In theory, the plan of distribution of seed through seed unions seemed to be sound enough but practical difficulties arose. The seed unions, in the first place, could not cope with the enormous demand and, therefore, resorted frequently to the mixed stuff purchased from the gin-owners. The result was that the *roseum* crop in some years, like 1921-22, was very impure. Again the cultivators preferred Berar *roseum* seed to that of their own district with the idea that Berar seed gave better yield. The demand for Berar *roseum* seed began from 1923-24. The seed began from 1923-24 The seed distributing agencies of the tahsil tried their best to supply Berar *roseum* seed but it was impossible for them to meet the vast demand. The merchants took advantage of this opportunity and imported from Berar for sale to the cultivators, seed which was by no means pure. The purity of the seed supply, even from the unions, was not very reliable as the central farms growing the pure crop did not renew their seed from the mother farm nor did they take sufficient care to maintain purity.

The amount of seed distribution is no sure guide to the area under any crop but it can safely be said that the area under *roseum* was on the increase, going upto 75,000 acres in 1929-30. The maximum was reached

in that year, after which it showed a decline due to wilt, and to the fall in prices because the market grew more exacting in its demand for a quality staple.

Extracts

SELF-HELP IN DENMARK.*

By Henry Arnold.

In the eighties of the last century Europe felt the first impact of the New World's wheat export. Her farmers staggered under the blow. Some countries, like France, and Germany concerned for their peasant soldiers, raised their tariffs. Others, like Great Britain, concerned for their great exporting interests, allowed the blow to reach the British farmer unsoftened. Denmark did neither of these things.

Before the full impact of the new wheat reached Europe the co-operative movement had made important strides in the industrial towns of England. In 1863 the Co-operative Whole-sale Society was formed. The movement made a deep impression on a Danish Clergyman who was at that time travelling in England.

Pastor Sonne of Thisted, in North Jutland, took the new doctrine back with him to Denmark. He began an assiduous propaganda in favour of the new movement. Three years after the formation of the Co-operative Wholesale Society in England, Sonne's propaganda bore its first fruits. A group of eighty-three men of Thisted, founded the first Danish Co-operative society.

The society, as they constituted it, was organised on extremely democratic lines. No restriction was placed on its membership. Co-operators were welcomed irrespective of religion or political opinion. Voting was not according tc the amount of capital invested, but was organised on the principle of one man, one voted. Women were not debarred from the franchise. They got their vote in the co-operatives sixty years before they got their vote in the State.

The members agreed to subscribe their capital in small weekly instalments. It was lent at a fixed rate, there were no " ordinary shares." No credit was allowed to purchasers. Everything had to be paid in cash.

* *Review of Reviews.* Sept. 1935.

Any surplus that accrued was to be distributed according to the amount of the investment.

It will be seen that there was a strong Socialistic tendency in this early organisation. Sonne published a small book in 1867 in which he explained the principles of the movement. He confessed that he had borrowed his ideas from England, and especially from the doctrine of the Rochdale Pioneers, that early, mute protest against the effects of the Industrial Revolution on the working class of Great Britain.

"We have" he wrote, "in every detail modelled our society on the English societies; we have not ventured any deviation from the rules which in England have proved by many years of experience to be right. To God we are only human beings—the division into classes prevailing in human societies seems unreasonable and unjust; that some few have the privilege of letting others toil and reaping the profit themselves, while others are bound in poverty is hard injustice. There is a lawful common right giving every human being the right to work and to help himself to the best of his abilities."

Sonne, however, insisted that, though economic advantages were directly involved, the aim of co-operation was essentially to aid the poorer classes to intellectual, moral, and social improvement. He argued that as long as the Danish peasant was sunk in misery, all the teaching of the church and of secular education was bound to remain barren. Give the peasant a decent house and a square meal. He will then be in a receptive mood. Not a word would have been out of place in the mouth of an English Christian Socialist.

While there were many who followed the pure word, economic necessity was not yet pressing enough to galvanise the movement into vigorous life. It is probable that Sonne's organizing capacity was not so great as his idealistic fervour. The movement spread slowly. Faber set up a central store for joint purchasing in 1876, but the enterprise failed and brought down many smaller societies in its failure.

With the coming of the new wheat from over the Atlantic, Denmark was threatened with ruin. Natural conditions there, are not ideal for agriculture or industry. Her soil is thin and her summer short. She is swept by the Northern winds. She has neither coal nor water power. Without the capacity to export her agricultural produce Denmark standard of living would be miserably low. She has none of the compensa-

tions in the way of timber or ores enjoyed by her Scandinavian sisters, who are thereby relieved of the necessity of a large agricultural export.

Denmark, however, was not defenceless. Sonne's propaganda had made the idea of co-operation grown in the country. The famous Danish High Schools, private schools which concentrated especially on the peasantry, helped in producing among the peasantry a wide-wake and receptive frame of mind. And at the critical moment there appeared a man of great organising ability who for many decades was to guide the destinies of the Danish peasant.

Severin Jorgensen was a retail dealer in a small Danish town. It had been the retail dealers who protested most vigorously against the co-operative movement at its inspection. Jorgensen saw the possibilities of the movement. It meant the ruin of the class to which he belonged. But it also meant the salvation of the Danish farmer. In England or France he would have become a Keir Hardie or a Jean Jaures. In Denmark he became the giant of co-operation.

Like Pastor Sonne, he had a socialistic tinge. "Man" he wrote "can only develop his abilities in society with others. Progress has only been made in the same degree as man has realised his dependence on his fellow-men and co-operated with them." Unlike Sonne he came at a moment when real danger was threatening the individualist farmer of Danish tradition. Also unlike him, he was an organiser of first rate ability.

The impetus thus given to the co-operative movement was not exhausted until the whole country had been covered with societies. In 1876 their membership had been 15,000. At the turn of the century the number was over 50,000. Nine years later it was 170,000, and at the present day it has been estimated at 300,000. Thus about one-third of the Danish tax-payers are members of co-operative societies. There are now about 1,800 societies in Denmark. There are only 1,400 urban and rural districts in the country. The whole land is covered with co-operative societies.

The organisation has not lost its early leaning towards democracy. In the eighties a central Wholesale Store had been founded in Jutland with Jorgensen as manager. Later a similar establishment was established in Zealand. In 1896 they combined to form the Danish Wholesale Society. At the time of its foundation there were 310 local societies. They did not lose their independence in the larger organisation. They were not even compelled to make their purchases through it. Neverthe-

less it offered obvious economic advantages and at present about 85 per cent. of the total purchases are made through the Danish Wholesale Society.

The turnover of the central organisation increased rapidly. In the nineties of the last century it was under 5,000,000 kroner. In 1908 it had risen to 40,000,000, in 1922 to 123,000,000. Since the war it has risen less rapidly, but nevertheless perceptibly. Its sales concern mainly groceries, drapery and boots and shoes.

The co-operators did not forget the research side of agriculture and commerce. Much of the seed formerly supplied to the peasants by retailers had been adulterated. The Danish wholesale Society employed expert testers and graders to ensure that the peasants were receiving the genuine article. Architecture were called in to advise on the best type of farm buildings. Chemical research, particularly on the subject of artificial fertilisers, was also enlisted in aid of the movement. Some idea of the vigour of the organisation is gained from the fact that the fortnightly paper published by the Danish Wholesale Society has a circulation of 200,000.

"The two breasts of France," exclaimed Sully, "are the plough and the cow." The two breasts of Denmark are the sow and the cow. There are indeed important wheat and rye growing regions in Denmark. But where as English farmer often keeps livestock solely in order to fertilise his fields for the corn-crops, the Danish farmer reserves a large part of his corn-crops to feed his animals.

This type of husbandry is of comparatively late introduction. It dominates the country.

The number of cattle has more than doubled in the last seventy years, the number of pigs has increased tenfold. The export of butter has risen from 6 kilograms in 1860 to 160 kilograms at the present day, that of bacon from 3 kilograms to 306. The export of eggs has increased more than fortyfold.

Butter is essentially an export article and milk an article for local sale. In order to compete with the farmers of Great Britain, Denmark's largest customer by far, Danish farmers have to convert their milk into butter. Thus a natural division of labour has sprung up. The British farmers supplies the milk, the Danish farmer the butter.

Butter. implies buttermilk and buttermilk implies swine. Here again, by a natural evolution, the Danes have arrived at an essentially

exportable article. Great pains have been taken to develop bacon production. Just as the resources of the co-operative organisation were put at the service of butter, so they were also mobilised to secure the best and most uniform types of bacon.

Their success has been astonishing. Over four-fifths of Denmark's total export is agricultural export. By far the larger part of her agricultural export is composed of butter, bacon, and eggs. The Englishman's breakfast provides the funds where with the Danish farmer heats his stove.

Parallel with their success in keeping their export markets, the co-operators of Denmark have won spectacular victories against large, capitalistic combines. They have beaten off determined attacks made by rubber, cement, artificial fertiliser and flour concerns Most spectacular of all has been their victory over the large-scale "estate" farms. Even before the war over eighty per cent. of the farms from 150 to 600 acres had joined some sort of co-operative society. About one half of the estates of over 600 acres were members. It is not even necessary in every case to supply share capital. An undertaking on the part of a group of farmers to deal only with their co-operative is often considered by the banks sufficient security for a loan.

SUCCESSFUL ORCHARDING.*

By H. B. Terry.

With the approach of the planting season for deciduous fruit trees, many questions come up for consideration so as to avoid mistakes which may be difficult, perhaps costly, to rectify at a later stage.

Essentials for success.—The selection of a suitable site, one with a fair depth of soil, naturally well drained, not too steep and if possible with an easterly to north easterly aspect, should be the first consideration. The arrangement of the trees can be considered at a later stage. The preparation of the land is usually the next problem that needs attention. Here one may deviate and say that placing the order for the trees is of greater importance for, as nurserymen execute orders in rotation, they cannot reasonably be expected to hold back their best trees and the leading varieties pending the arrival of late orders.

Once the area to be planted and the system of planting to be adopted are known, it is a simple matter to compute the number of trees required. By multiplying the distance the trees are to stand apart in the rows by

* *Farming in South Africa.* Vol. X, No. III. June, 1935.

the distance between the rows, and dividing the product into 43,560 (the square feet in an acre) the quotient will indicate the number of trees planted square per acre. Then order the trees immediately, and stipulate first-grade ones.

Shelter belts.—Shelter-belts are absolutely essential to success in commercial orcharding. The shelter trees should, if possible, be planted a year or two in advance of the fruit trees; meanwhile other crops may be grown and the ground cleaned of weeds. Too much emphasis cannot be placed upon the need for protecting the orchard; the shelter-belt breaks the force of strong winds, permits trees to grow upright, reduces loss of fruit by windfalls, enables bees to work more freely among the blossoms to facilitate cross pollination, etc., yet many a young orchard is planted with only a wire fence around it!

Provide for cultivation.—There is often a tendency to space the trees closely together, losing sight of subsequent development; at a later stage cultivation is restricted and the trees do not produce as abundantly as they would have done had they been given ample room. Judging from the remarks of appreciation that are frequently overheard when passing through or close by an orchard, it would appear that methodical planting of the trees adds beauty to the landscape.

Order and beauty may be obtained by planting the trees at such distances apart in rows as well to allow all cultural operations to be performed without risk of injuring the trees. It may be as well to emphasize that fruit trees are a permanent crop, and that once they are established alterations of the plan are costly. Overcrowding should be avoided by arranging the trees 22 feet apart each way; if planted square this distance will allow of 90 trees being set out per acre, if the triangular system is used, it allows of 15 per cent more-i. e., 103 trees.

Planting new ground.—When selecting land for orcharding, a certain amount of care should be exercised, especially as regards soil depth drainage, and shelter from prevailing winds. Where a choice is permitted it would be as well to select land with a gentle slope of, say, two to three feet in every hundred, facing east or north-east, for preference. Steep slopes should be avoided, on account of possible soil erosion, and difficulties to be overcome when cultivating and spraying.

An orchard should never be established on low-lying ground, as such a site is devoid of proper air, drainage, is generally subject to severe frosts which would ruin the blossoms in spring, and the trees are also liable to suffer from "wet feet". Under such conditions, success could

not be hoped for. Having surmounted the initial as well as an important factor, the preparation of the soil for the reception of the trees should occupy the attention of the orchardist.

Soil preparation.—Fruit trees differ markedly from annual crops in their soil requirements, yet how frequently it happens that orchard land receives less attention than that which is to produce oats or other cereal crops; While it is true that some land may be ploughed over and planted immediately, in the majority of cases the practice is of doubtful value.

Before planting, ploughing, harrowing and cross-ploughing should be thoroughly done; the soil should never be allowed to dry out, and constant cultivation should be kept up to destroy weeds and so conserve soil moisture. It is practically impossible to find an agricultural publication which does not emphasize the necessity of thoroughly preparing the soil where heavy yields are expected. How much more attention, then should be given to the orchard site, considering the length of time the trees are to occupy the land? No one can possibly hope to be successful by just digging holes in the veld and planting trees at stated distances; yet it is attempted. To try to save money at this stage is false economy.

Agricultural dynamite is often used as an aid to soil preparation by exploding a charge where each tree is to stand on stiff soils, and where "hard-pan" exists close to the surface, there is much to be said in favour of its use, provided care is exercised to break down the pot-holes where the explosion occurred. Failure to do this will result in stunted growth.

System of planting.—The system of placing or arrangement of the trees is a personal matter which must be decided upon before the pegs are put into indicate where the trees are to stand. Taking a broad and practical view, and weighing up the advantages, etc., the writer has no hesitation in recommending the "square system" of planting; although advantages are claimed for other systems, it is felt that they are more heoretical than practical. When the holes are to be dug, the use of the "planting board" is necessary, as it provides for two page, one on either side of the hole, and when replaced indicates the spot where the original peg stood.

Do not purchase cheap trees.—Neither cheap nor poorly grown trees should be purchased, for they seldom give the same satisfaction that robust, well-grown trees do. Unless orders are placed early with nurserymen, there is generally some difficulty in obtaining just what is ordered and others are suggested as being just as good or a second-grade tree is purchased, to get the variety. Still, if one is to succeed and get a return

at the earliest possible date, it is worth while to pay a few pounds extra and get the best, A good type of tree to plant is what nurserymen term "first-grade"; such a tree constitutes one season's growth from the bud or graft, is not less than 4 feet high, and about ⅝ of an inch in thickness at the point of union. Trees of this description are worth planting, whereas others are not, no matter how cheaply they are obtained. The acceptance of substitutes for varieties unobtainable in the season when one intends to plant is to be deprecated; no time is saved nor any object served (except filling up the space), because the grower who is out for business will never be satisfied until he has "worked over" the substitutes to the desired variety.

Plant suitable varieties.—The general laws as to the adaptability of the various varieties to different districts are based to a great extent upon the date of blossoming, ripening and rainfall. There are other factors which need not be detailed here, and intending planters are advised to consult those growers who are established in each district. Be guided by their experience or communicate with your nearest School of Agriculture, for when selecting varieties the grower not only wishes to obtain trees which will succeed in his district, but will produce fruit adapted to the market where they will be finally tested.

One of the most important phases of successful orcharding is that of planting a few varieties, in order to facilitate cross-pollination of those varieties which are more or less sterile. It would be very disappointing after planting a commercial orchard to observe large healthy trees failing to produce good crops, in spite of abundant blossoming. Frost is often blamed for this condition, and such blame may be justified in some exposed positions on the high-veld, but generally it does not hold good. It would be a wise precaution when planting to intermix several varieties of apples, pears almonds, or plums which blossom at the same time, by alternating, say, four rows of each variety, rather than planting each variety in one large block.

Treatment of trees after planting.—When planting has been completed, the young trees require to be cut down—"headed back" to a height of 15 inches (knee high) from the ground, to produce several strong well-shaped growths, which later become the main arms upon which the "low-headed" tree is built up. Low-headed trees have special advantages over long-stemmed trees, chief among which may be mentioned the elimination of sunscald on the stem, uniform and sturdy growth, economy

of harvesting, spraying, pruning and the decreased danger from strong winds.

Protecting the trees against injury.—In various district hares and small buck often seriously injure young trees, by chewing off the bark. This is no doubt due to the shortage of green or succulent food on the veld. Protection can be afforded by lightly tying mealie stalks, canvas, or paper around the stems as a temporary measure, as it must be removed when growth is advanced and there is food on the veld for the animals. A permanent protection is provided by enclosing the orchard, gates too with wire netting, or by placing a cylinder of wire netting around each tree to a height of about 18 inches and a few inches in the soil. Each wire cylinder should have two stout stakes inside, to prevent animals from pushing it against the stem. Some growers simply depend upon the winter spray of lime and sulphur—1 part to 10 parts of water—to deter vermin, but this involves a certain element of risk.

Gleanings.

Dairy Hygiene and High-quality Cream.—Seldom have the main essentials of dairy hygiene been more forcibly and more strikingly expressed than in the closing remarks of the Scotch lecturer to a class of veterinary students. "Gentlemen" he said, "all that you need to remember is that the cow produces milk and dung with equal facility. The whole secret of producing clean milk lies in keeping the two apart." If the speaker's bluntness is excused on the score of his nationality, and the remarks interpreted in a general sense, it must be admitted that they contain a good deal of truth. Good cream, and good milk all depend upon the maintenance of a satisfactory standard of cleanliness. Milk, as produced by a healthy and properly fed cow, is in itself absolutely pure, but between the process of milking and the delivery of the cream at the factory there are numerous opportunities for it to pick up all kinds of foreign materials and flavours. The greatest danger lies not in the visible dirt, but in the microscopic sources of infection. It is such material that the lecturer includes in his expression. He reminds us in effect that the outside of a cow is comparatively unclean compared with the inside of the udder. It is quite definite that the quality of butter depends upon the quality of the cream supplied to the factory. Overripe cream is caused by excessive acidity which develops when cooling is not practised after separation. To prevent, separate at a test of not lower than 45 per cent. and cool immediately afterwards, Store in a cool place

and do not allow too long periods to elapse between deliveries to the factory. Fermented cream results from the growth of certain gas-producing germs in the product. These organisms come originally from cow manure and gain entry into the milk in the yard. Fermented cream is an indication that milk is being produced under unclean conditions. Manure should be removed promptly from the cow shed. Strict attention should be paid to cleaning the plant and premises. Use boiling water for scalding utensil morning and evening. Wash each cow's udder and milk with clean hands. Cool the cream after separation. Stale cream is caused by holding it too long at the dairy or by adding a small amount of left-over cream to the next can. The method of prevention is obvious. Another defect arising from infrequent factory deliveries and caused by overstaleness, uncleanliness, and germ infection is that of rancid or cheesy cream. This class of product is usually condemned as unfit for butter-making. A thorough cleansing of buckets, separators, milking machines, etc., is recomended, together with better regulated deliveries. An unclean flavour in cream is produced by faulty cleaning of milking machines, separators, and other utensils; by the use of old, broken and rusty vessels; using cloths for washing up, and by unclean methods in the dairy. Prevention lies in thoroughly washing all dairy utensils and in scalding them well in boiling water. This must be done immediately after each time they are used. Use clean, sound brushes instead of rags, and adopt cleanly methods throughout. Do not mix hot and cold cream. Wait until all is thoroughly cool first. The grazing of cow on rank growth of some weeds, clover, lucerne, and other feeds may give rise to feed flavours in cream. If possible, allow such fodder immediately after milking. Then remove the cows to ordinary pasture. Cool and aerate cream after separation. Curdy cream occurs when the product is too thin-below 38 per cent-and not kept cool. Cream should be skimmed to contain not less than 42 per cent. butter fat, be cooled immediately after separation, stirred frequently with a clean, tinned, metal stirer and kept cool during storage. Germ infection from swamps, dams, and low-lying paddocks is responsible for ropy cream. Cows should be prevented, as far as possible, from wading in such places; udders should be washed thoroughly before milking. White wash dairy and bails; scald utensils with boiling water to remove infection. A tallowy flavour is due to sunlight shining on the cream. This sets up a chemical change, particularly with high testing cream of 50 per cent. and over. The same defect may be caused by a germ infection. Keep the cream away from direct sunlight. Do not expose excessive surfaces of cream to the air for any length of time, and

keep all utensils and surroundings clean. Rusty cans and utensils and unclean tinware cause metallic flavours. Discard all defective vessels. Use only well-tinned seamless cans and buckets. Milk and cream have an exceptional capacity for quickly absorbing all kinds of flavours, and should not be left in a room where the exhaust fumes from the oil engine or odours of the engine are prevalent. Keep the cream away from oil on the floor, or on the separator block; from smoke from the fire, any strong-smelling materials, chemicals, and disinfectants. A room with a clean pure atmosphere is the best for storing cream. Do not wash dirty utensils with water from the engine jacket. A "cowy" flavour is the result of an unclean condition of the bails, floors, yard, etc. not washing the udder, milking with dirty hands milking unhealthy cows, or of using the milk too soon after calving. The udders and teats should be washed and milking done with clean hands. Bail should have concrete floors, and the yard should be kept clean. Never separate the milk from sick cows that have just calved.—(*Queensland Agricultural Journal.*)

Sunn-Hemp Retting.—The importance of establishing Indian sunn-hemp fibre firmly in the British market, where it is employed for the manufacture of such articles as ropes, cables, twines and nets, has been brought into prominence in recent years as a result of the investigation conducted by the Empire Marketing Board. It has been found that crude and careless methods of retting stand in the way of its more extensive use in the United Kingdom and also lower its value. Arrangements were therefore made during the year for the retting of sunnhemp in the laboratories of the Madras Industries Department, and a careful study was made of the temperature of the water, the effect of changing the water, the quality of the water, and the duration of the retting period. Important conclusions have been arrived at, but the experiments are to be repeated on a larger scale this year. (*Ind. and Eng. Chem. News* Edit. Vol. XIII, 1935.)

Ten-Minute Soil Analyzer—Economies in time that will result in increased yields through proper fertilization of agricultural fields, are made possible through a new soil analysis device originated in Honolulu. By it laborious chemical tests that normally require weeks to complete are replaced by a method requiring but a few minutes. As a result, complete plotting of the required fertilization of every part of a field can be secured while time is still available to make use of the information for the benefit of the then growing crop. Spotted fields will be eliminated; average yields will be increased; and the whole will be accomplished at

an infinitely decreased laborary cost. The apparatus for analyzing soils does in seven to ten minutes what formerly required five weeks. It is the development of chemists at the experiment station of the Hawaiian Sugar Planters' Association. Hamilton P. Agee, station director, has recently announced its successful tests. This development which may be described as revolutionizing methods of testing soils, is the fruit of two years of study and experimentation by personnel of the department headed by Francis E. Hance. Beginning with the crude soil-testing "kits" used by farmers elsewhere in the United States, experiment station chemists have worked out devices which combine the speed of those rudimentary indicators with the accuracy of a laboratory analysis. The result is nothing less than a precision machine, which is now in use on all plantations in the territory which maintain agriculturists. The "analytical assembly," as it is called, or rather the assemblies for there are nine of them for various analytical purposes, resembles, when closed, a box about 15 inches square and perhaps two feet high.—*(Scientific American)*.

Tomato Seed Selection.—In selecting tomatoes from which seed is to be saved, only that from the best yielding plants which conform strictly to the characteristics of the variety, both as regards type of vine and type of fruit, should be chosen. Several fruits should be cut open to be sure of the quality. A plant should be chosen that produces a large number of average size tomatos rather than a plant with two or three large fruits and a number of small ones. Care should be taken to see that the plant is free from disease, as several tomato diseases are transmitted by the seeds. The best method of separating tomato seeds from the surrounding pulp is as follows: Cut the fruit in halves and scoop the contents into a bucket, and when the latter is about half full, fill up with water, stand the bucket aside and allow the contents to ferment, which will take from two to six days, according to the warmth of the weather. A froth forms on top of the water when fermentation is sufficiently advanced. Wash the contents of the bucket on a fine sieve or a layer of hessian and the pulp will come right away from the seed, which must be spread out in a thin layer to dry. Rapid drying is important to prevent moulding. When dry, rub the seed in the hands to separate the individual seeds. Seed harvested in this manner has averaged 94 per cent. germination. As already indicated, selection from a plant which is free from disease is important, but as a further precaution the seeds should be dipped for ten minutes in a solution of mercuric chloride 1 part in 1,000 parts of water, before planting. Proper precautions must

be taken with mercuric chloride where there are children or animals, as it is highly poisonous if taken internally—*(Queensland Agricultural Journal)*.

Communal farms for unemployed women.—A scheme of communal farming for women, which would lift many despairing unemployed older women out of the misery they are now enduring, is being considered by women's organisations in England. The plan is to settle groups of perhaps a dozen women on farms near big towns. They would learn poultry-keeping, bee-keeping, butter-making, market gardening, milking, cheese-making and the growing of vegetables, fruits and flowers. To cut out middlemen's profits the produce of the farm would be sold direct to the consumer, and the "communal" farmers would have a travelling shop from which they would sell milk, butter, cheese, honey, fruit and vegetables. The profit would be shared between workers, and they would be relieved of the present dread of being without food and lodgings. The women would not be left to work the farms alone. They would have a trained, practical overseer to whom they would be responsible. Of course such a big scheme for the thousands of unemployed older women who cannot hope to be reabsorbed in industry, needs careful planning and financial backing. D. Kate Barrett, Principal of the Horticultural College Swanley, Kent, said that one association of women has approached her about the scheme. "I have considered it very carefully", she said, "and I see no reason why it should fail. If I were free to do it I would like to have twelve unemployed older women at the College, I would give them a year's training in all branches of farm work and let them carry through the scheme in a small way. I see no reason why women should not be successful on the land just because they may have failed else where. Of course the women would need to put their whole heart into the work, for farming is a wholetime job. I would like to make the demonstration to see if the communal farms run by women would pay. The test would take at least three years." Dr. Barrett added that before she could do this she would require the consent of the Ministry of Agriculture and the Governors of the College. Some of the Women's Associations are considering approaching the Ministry of Agriculture with a request for the inclusion of unemployed single women in the Government's Land Settlement Schemes. (*The Hindu*).

Current Research.

Composition and properties of superphosphate.—II. **Free Acid in Super phosphate** by Hill W. L. and Beeson K. C. *Journal of the Association of Official Agricultural Chemists.* Vol. XVIII 1935 Page 244). A study was made of (1) the composition of superphosphate solutions, (2) the relation between the age and the free acid content of superphosphate, and (3) existing methods for determining free acid by extraction with organic liquids. Ether, absolute alcohol, 95 per cent alcohol, acetone, and ethyl formate were used under carefully standardised conditions to determine the free acid in standard equilibrium mixtures of monocalcium (also dicalcium) phosphate and aqueous phosphoric acid and in representative samples of commercial superphosphates. The results show that with the possible exception of ethyl formate these extractants are capable of giving good results over the ranges of free phosphoric acid and free water that are usually encountered in commercial superphosphate that has not been treated with ground limestone or other "conditioners." (*Author's summary*).

Comparative study of the official and modified method for determining available potash in mixed fertilizers.—by Kraybill H. R. and Thornton S. F. (*Journal of the Association of Official Agricultural Chemists*, Vol. XVIII 1935 Page 260). Failure to recover completely the added potash in mixed fertilizers by the official method is due chiefly to the incomplete removal of potash from the residue in the preparation of the solution, to loss during ignition through spattering and formation of difficultly soluble metal silicates of potassium, and to occlusion or absorption by precipitate formed from the addition of ammonium hydroxide and ammonium oxalate. Minor losses may occur through the solvent action of the 80 per cent alcohol used in washing the potassium chloroplatinate precipitate. Loss during ignition is prevented by using a specially designed burner top which permits gradal heating of the dish at low temperatures on the sides as well as on the bottom. Failure to secure complete extraction and losses by occlusion are overcome by the use of a modified method in which the solution is prepared by boiling the sample in a 250 cc.volumetric flask with 50 cc. of saturated ammonium oxalate solution and 150 cc. of water for 30 minutes. A slight excess of ammonium hydroxide is then added, and after cooling the solution is made to the mark and filtered. Sufficient potash-free normal sodium hydroxide is added to the aliquot of the solution to prevent the formation of free phosphoric acid during ignition, and the

procedure is continued according to the present official method. A comparison of the official and the modified methods on 51 samples of fertilizers submitted by manufacturers from all parts of the country and on 33 official samples obtained in the inspection work in Indiana in 1933 shows that the modified method yields higher results in most cases. The average of the increases for the 84 samples is 0.24 per cent. The increases range from less than 0.10 per cent to over 0.80 per cent. The results indicate that the losses by the official method are greater when the potash in the fertilizer is derived from sulphate rather than muriate of potash and when the superphosphate is derived from Tennessee rather than Florida rock. The losses appear to be less when ammoniated superphosphate is used than when superphosphate is used. Addition of lime did not appear to have any definite effect on the loss of potash. Only slightly lower results were obtained when the weight of the potassium chloroplatinate was determined by difference after washing it from the crucible and reweighing the crucible. The use of 95 per cent alcohol for the first washings followed by 80 per cent alcohol for the final washings resulted in only slightly higher results. The modified method yields a solution that contains a higher amount of soluble P. 205. The addition of sufficient potash-free sodium hydroxide to the aliquot to prevent formation of free phosphoric acid prevents losses during ignition, as shown by the higher results obtained when sodium hydroxide is added and by its effect in preventing loss of weight in the silia dishes. The modified method does not give significantly higher results than the official method with potash minerals (ground to pass a 1.0 mm.sieve), such as muscovite, orthoclase, green sand, and Cartersville shale. Analyses by the official method of various laboratory mixtures of fertilizers containing superphosphate, muriate of potash, sulphate of potash, hydrated lime, sodium sulphate, and ferric chloride are frequently lower than the theoretical amount. Analyses of such mixtures by the modified method agrees very closely with the theoretical amounts of potash. There is a source of error due to the non-uniformity of the 2.5 gram samples weighed out which needs further study. There is a close correlation between the increases obtained by the modified method over the official method and the availability of the potash in the residues of samples of fertilizers as determined by the Neubauer method and pot tests. The increased amount of potash obtained by the modified method is available to plants. (*Author's summary*).

The Clay Content or the Soil as related to Climatic Factors, particularly Temperature.—by Jenny H. (*Soil Science*, Vol. 40, Page 111, 1935). The

clay contents of 151 soil profiles developed on crystalline rocks in the Eastern United States were correlated with climatic factors. It was observed that within each of seven different groups of parent materials the average clay content of the soil increases from north to south. Temperature is considered to be the major factor that is responsible for the high clay levels in the South. For constant moisture values the clap-temperature function is of exponential nature and resembles Van't Hoff's temperature rule. An idealized clay climate surface has been constructed which shows the variation of "climatic clay" in soils derived from granites and gneisses as a function of moisture and temperature.

Investigations on the Role of Organic Matter in Plant Nutrition Part VI.—Effect of injecting Minute Quantities of Certain Forms of Organic Matter on Plant Growth and Reproduction : by Iyer C. R. H., and others. *(Proceedings of ths Indian Academy* Volume I. Page 381, 1935). Injection of minute quantities of certain organic extracts into mature sunflower plants led to not only better growth but also greatly increased flowering. The best results were obtained in the case of plants receiving extract of yeast or farmyard manure: the total yield of flower and seed was nearly tripled and the ratio of seed to the rest of the plant nearly doubled as compared with the untreated (control) plants. Dried blood was comparatively ineffective. Injection into tender plants did not lead to any significant improvement in yield. Comparative trials with inorganic salts which were fed directly to pot or pot-cultured French beans or barley did not lead to any marked improvement, more satisfactory results being obtained by applying the same salts (though in larger quantities) to the soil. In the later case, the beneficial effects could be traced to increased assimilation and better general development rather than to any alteration in the ratio of seed (pod or grain) to the rest of the plant. The practical significance of the above and other observations has been discussed. *(Author's summary).*

Crop Forecasts.

COTTON.

First forecast of the cotton crop of the Central Provinces and Berar for the season 1935-36.

On an average of the five years ending 1933-34 the area under cotton in the Central Provinces and Berar represented about 19.0 per cent of the total area under the crop, In British India.

Sowings started a little early in Nimar, Chhindwara, and Bilaspur; late by a week to a fortnight in Bhandara and in the Berar districts (18th to 26th June) and about the normal time in the rest of the province. Local showers were received in the province in the second week of June but the regular monsoon which was weak at the outset did not set in till before the third week of that month. The rainfall in July was continuous with intermittent heavy showers. Sowings were generally made under favourable conditions and germination was successful but some resowing was done in places in Jubbulpore, Chhindwara, Wardha, Nagpur, Chanda and Amraoti districts on account of heavy and continuous rain. The crop is in a satisfactory condition so far (1st August 1935) but a long break with sunshine is urgently needed for the healthy growth of young plants and to enable completion of weeding and intercultural operations. The table below compares the curent season's total estimated area under the crop with the corresponding and actual areas of 1934-35:—

	Estimated area sown during the year under report (1935-36)	Estimated area of the corresponding forecast of last year (1934-35)	Actual area of the last year (1934-35)	Percentage of increase (+) or decrease (—) of column 2 over Column 3.	Percentage of increase (+) or decrease (—) of column 2 over Column, 4
1	2	3	4	5	6
	Acres	Acres	Acres		
Central Provinces.	1,388,239	1,401,504	1,286,552	—5	+4
Berar.	2,893,326	2,901,982	2,914,886	..	—1
Total.	4,281,565	4,303,486	4,201,438	—1	+2

The slight increase in the estimated area over the actuals of last year is attributed to favourable conditions at sowing time.

SUGARCANE.

First forecast of the sugarcane crop of the Central Provinces and Berar for the season 1935-36.

Note.—On an average of the five years ending 1933-34, the area under sugarcane in the Central Provinces and Berar represented about 0.8 per cent of the total area under the crop in British India.

The planting of sugarcane was started at the normal time (1st December 1934 to 28th April 1935) throughout the province.

Area planted-The total estimated area this year under sugarcane in the Central Provinces and Berar is reported to be 29,768 acres. It is larger than the corresponding (28,262 acres) and actual (28,890 acres) of last year (1934-35) by 5 and 3 per cent respectively. The increase in area is attributed to favourable sowing conditions and slight rise in the price of "*gur*."

Departmental News.

Leave on average pay for 2 months is granted to Mr. R. R. Kulkarni, Farm Superintendent Yeotmal, in extension of the leave already granted to him.

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Leave on average pay for 15 days is granted to Mr. A. S. Bakre, Agricultural Assistant, Malkapur in extension of the leave already granted to him.

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Leave on average pay for two months is granted to Mr. Govind Prasad Extra Assistant Director of Agriculture Jubbulpore, with effect from the date he is permitted to avail himself of it.

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Calender of Operations.

FLOWERS.

By R. N. Sinha.

August.—Seeds for cold weather use may be ordered during this month. Any of the following seeds may be ordered according to one's choice. When the seeds have been received they should be kept in air-tight tins, bottles or boxes till they are required for sowing:—

Gypsophilla.
Gereniums.
Helichrysum (Everlasting flower)
Linum Grandiflorum (Flot)
Nasturtium.
Pansy.
Petuna..
Poppy.
Phlox.
Mignonette.
Salvia.
Sweet Pea.
Small sunflower.
Astar.
Anterrihinum (Snapdragon)
Alyssum.
Carnation.
Candytuft.
Cornflower.
Coreopsis.
Calandula.
Chrysanthemu Sagetum.
Datura.
Dianthus chinencis (Pinks)
Gillardia.

Seed beds as suggested in the month of May, may be prepared, manured and kept ready for sowing. The seed beds must be forked just a day or two before sowing seeds as the seeds germinate better on freshly dug soil. At the time of sowing the condition of the seed bed soil should be moist.

In order to obtain good results from sweet peas, have the trench dug to a depth of about 1½ to 2 feet and after mixing in well-rotted cattle dung manure in the excavated soil fill the trench and occasionally have the surface forked in order to keep back the weeds till sowing in October. Planting of croton cuttings, hedges and borders may be carried out in this month also.

Whenever weather and time permit, do not fail to hoe the flower beds.

For obtaining early flowers acclimatized astar and salvia splendens seeds may be sown in boxes or pots, by the middle of this month.

If not already done, stake the chrysanthemums and also do not fail to water them on open days. They should not be allowed to flag.

September.—First sowing of acclimatized seeds may be done in the first week of this month and second sowing of English seeds (imported) in the second and third weeks in instalments.

Seeds of tap rooted annuals such as candytuft, mignonette, nasturtium, alysseum may be sown in the last week of this month,direct in the ground where they are to grow.

If possible, first and second sowings of all the seeds which require transplantation may be done in boxes or pots instead of beds, of particularly delicate seeds like poppy, petunia, nicotiana,

Palsams will be coming to an end this month and they should be removed without delay. The seeds obtained from these are not of much use since acclimatized seeds produced only single flowers.

In order to obtain big blooms on chrysanthemums disbudding and application of liquid manure should be started in this month.

Seedlings of salvias and acclimatized astors will be ready for planting. They may be transplanted in beds or potted in pots and transplanted in beds later on.

Operation of putting cuttings of different shrubs may be started in this month.

Budding of roses also can be started by end of this month.

October.—Sowing of flower seeds, budding of roses and planting of cuttings may be continued during this month·

The rainy weather annuals which may be finishing up should be removed. If desired seeds may be collected from cosmos, cleomia, celosia, gamphrena, melampodeum, torenia, sunflower and amaranthus, but it is no good collecting zinnia seeds. As a rule acclimatized zinnia seeds produce mostly single flowers.

After preparing the beds any seedlings which may be ready from September sowing may be transplanted.

Sweet peas, candyfuft, mignonette alyssum may be sown direct in the ground where they are to grow. Sweet pea seed would germinate better and earlier if soaked in water for about 12 hours before sowing.

Pruning of roses and flowering shrubs may be carried out in this month.

Violets may be re-potted,

VEGETABLES.

August.—Acclimatized cauliflower seeds may be sown in the first week where an early crop is required. As a rule cauliflowers produced from this seed are small, loose, and yellowish in colour, while those grown out of English (imported) seeds are solid, larger and whitish in colour and give good results.

The sowings of English cauliflower and cabbage seeds may be taken up from the middle of this month and may be continued till the end of September, at intervals of 10 or 12 days.

The first and second sowings may preferably be done in boxes and as the seedlings have produced five leaves they may be transplanted 2 or 3 inches apart on raised seed beds, prepared beforehand for the purpose.

The seed beds should be 6 to 9 inches higher than the ground level, and about 4½ feet broad and the length can be according to convenience.

During this season caterpillars are very troublesome to these seedlings. The following hints may be of some use.

Keep the surroundings free from weeds and grass. Hand picking of the caterpillars and spraying with arsenate of lead are more beneficial. If this is not available dusting with wood ashes is recommended.

In places where the duration of the cold season is short only early varieties of cauliflowers should be grown.

Early varieties.—Early Eurfurt, Early Snowboll, Early Paris and the early giant.

Late varieties.—Magnum, Benum, Welchern, Large Aseatic. One ounce of seed contains about 1000 seeds of cauliflower and about 800 seeds of cabbages.

It is desirable to sow a little more seed than is actually required for the area to be planted, specially in cases of cauliflower, cabbage and knolkhol. Not more than 50 per cent of the seed may be expected to produce good seedlings for planting.

Lettuce seeds also may be sown in this month for an early crop but these will not be nice and full.

Brinjal seeds can be sown for the cold season crop. Country radish seed may be sown direct on ridges.

September. The following vegetables may be sown in this month:—Cabbage, Cauliflower, Knolkhol, Lettuce, Tomato, Brinjal, Beet, Turnip, Carrot and Radish (Local and imported.)

Knolkhol seedlings will have to be raised in the same way as cauliflower and cabbage.

Lettuce, tomato and brinjal seeds will have to be sown in beds and seedlings, when ready, transplanted in their permanent places.

Seeds of beet, turnip, carrot and radish will have to be sown direct in the beds where they are to be grown.

French beans may be sown in the last week of this month as a trial.

October.—All the vegetables recommended for the previous months may be sown (except cauliflower) with advantage in this month for successive crops with better results.

In addition to the above-mentioned crops, peas, onions and spinach may also be sown in this month.

Mint may be transplanted.

College and Hostel News.

For the first time in the history of the hostel it has been completely full this year. For want of accommodation the guest room and the sick room will have to be used as Student's rooms when the compartmental students of the B. Ag. and the I. Ag. classes rejoin the College. With the growing popularity of the Agricultural College, it will become very necessary to extend the Hostel to accommodate more students.

We thank Mr. Sridhar Rao Gokale B. A. LL. B. Pleader, Nagpur for all that he has been doing to make the Agricultural College popular among the public. The monthly coffee parties which are arranged at his residence, and at which the leading gentry, both official and non-official, and batches of students of the College of Agriculture meet will, we are sure, have a very salutary effect on our boys and also give an opportunity for the public to assess the merits of the students of the College of Agriculture properly.

We are proud to learn that Mr. M. K. Nagmote B. Ag. an old boy of this college has passed the LL. B. examination of the Agra University with distinction. We hope that Messrs P. M. Ganorkar Y. K. Dhabadkar and S. R. Pitale who have joined the Nagpur College of Law will acquit themselves creditably.

We heartily congratulate Mr. V. G. Vaidya B. Ag. on his having secured the king Edward Memorial scholarship for Foreign studies. He has chosen to specialize in England in preservation of fruits. He sailed in the beginning of September. We hope he will return equipped with the necessary knowledge to stimulate this branch of agricultural industry in this province.

We also convey our best wishes to Mr. Gyan Singh Bhatya M. Sc Lecturer in Botany who has proceeded to London for higher studies.

We have great pleasure in welcoming in our midst Mr. S. B. Vaidya B. Ag., who on his return from Pusa after under-going Post-graduate training in Botany, has been appointed temporary lecturer in Botany in place of Mr. Bhatya.

The College Cricket team has been seen on the grounds more often this year than ever before. This is due to the untiring efforts of the captain Mr. V. T. Tanksale who is very popular among his colleagues. The College team has a good addition in Mr. S. Tanksale of the first year. The Foot Ball and Hockey teams are also very active. Unfortunately the continuous rains have been unfavourable for frequent practice.

The students of the college celebrated *Janmashtami* and *Ganesh* Festivals, with great *eclat.* This year in addition to the usual items of merriment two plays, one in Marathi (*Andhalyachi Shala*) and the other in Hindi (*Shrimati Manjari*) were enacted with great success. We congratulate Messrs. S. P. Pimplikar P. R. Roday, N. V. Bapat and Mr. B. V. Dhok, Gupta, P. M. Shrivastav, Kachawa, Shakergayan and others on their excellent acting.

We are very thankful to Mr. B. R, Phatak, and Mr. Ram Narayan Kayastha for the trouble they have taken to conduct rehearsals and to arrange the stage.

The College Debating Society.—The following office bearers were elected in a general meeting held on Saturday the 23nd June 1935 for the year 1935-36.

Presideut.—Mr. J. C. McDougall.
Vice President.—Mr. U. G. Deshpande.
Secretary.—Mr. T. N. Koyal.
Jotnt Secretary.—Mr. P. R. Rode.

Members of the Managing Committee.

Mr. T. J. John.
Mr. M. S. Nair.
Mr. W. S. Dehadrai.

The first meeting of the debating society was held on Saturday the 20th July 1935 at 8 p. m. in the College Hall with Mr. U. G. Deshpande in the chair.

The following resolution was discussed:

"In the opinion of this house the introduction of modern civilization into Indian villages has done more harm than good."

Mr. B. R. Phatak moved the resolution and Mr. P. D. Nair opposed it. Messrs. T. G. Deshpande, T. J. John, M. S. Nair and B. S. Rao took part in the discussion.

The resolution was put to vote and was declared carried.

We take this opportunity to express our sincere thanks to all the speakers for having responded to our invitations at considerable personal inconvenience.

We extend a hearty welcome to the freshers. From what little we have seen, we can say that they are a very promising lot and will bring honour and credit to our debating society.

The Nagpur Agricultural College Magazine

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NOVEMBER 1935

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COLLEGE OF AGRICULTURE, NAGPUR

Contents.

J. H. RITCHIE, ESQ., M.A.

Mr. J. H. RITCHIE, M. A., B. Sc,

AN APPRECIATION.

It was just two years ago that we had the pleasure of congratulating Mr. Ritchie on his appointment as the Director of Agricultural of this province, and it was not anticipated that he would bid farewell to us in such a short time. Mr. Ritchie joined the Indian Agricultural Service just over twenty-two years ago. Since then he has seen service not only with the Local Government but also with the Government of India, both in the Civil and Military departments. For several years he was Deputy Director in the wheat tract of this province and contributed in substantial measure towards the organization of the departmental work in those districts. Subsequently he held the posts of Deputy Secretary and Secretary of the Indian Central Cotton Committee where his ability and initiative found full scope in extending the usefulness of the Committee to all connected with the production of, and trade in, cotton. He also held the post of the Principal of the College of Agriculture Nagpur for a short time before he was appointed to succeed Mr. Plymen as Director of Agriculture.

It is unfortunate that Mr. Ritchie's tenure of office as Director coincided with a period of acute financial stringency which prevented the expansion of the department to the full extent he would have liked. Nevertheless, his great zeal and enthusiasm have infused a new spirit into the working of the Department, and his robust optimism has been a source of inspiration to all who worked with him. The sympathy and consideration with which he administered the Department made him popular with all his staff.

Mr. Ritchie has gone to the United Provinces to take up the post of the Director of Agriculture left vacant by Mr. Allan whose name is so intimately associated with our College. It may confidently be expected that the stimulus given to the development of agriculture in the sister province by Mr. Allan will be maintained and intensified under Mr. Ritchie's regime.

The staff of the Central Provinces Agriculture Department and the students of the College unite in wishing Mr. Ritchie every success in his new appointment.

Mr. J. C. Mc DOUGALL, M.A., B. Sc. (*Edin*), I. A. S.

We congratulate Mr. J. C. McDougall on his appointment as Director of Agriculture, Central Provinces. Appointed to the Indian Agricultural Service in 1920, Mr. McDougall has spent practically the whole of his service in these provinces and this has enabled him to obtain that intimate and practical knowledge of the local Agricultural conditions and rural problems which is an essential pre-requisite to success in the work of scientific progress. By 1926, he had already made a name for himself and was selected to serve on the Royal Commission on Agriculture in India. This offered him the unique opportunity of obtaining first hand knowledge of agricultural practices and the work of development in the various provinces of India. No member of the Service has wider experience than Mr. McDougall and the Central Provinces Department of Agriculture is very fortunate in having at the helm a man of his calibre, experience and capacity.

His appointment as Director, however, means a big loss to the Agricultural College to which he gave his best at all times and which he has so ably managed since 1932. The keen interest he took in his students and the encouragement he gave in developing original ability wherever it was shown will always be remembered. His high sense of integrity and fine ideals will leave an indelible impression on the institution and will be a source of encouragement and inspiration to future generations of students. To the members of his staff, he was always kind and sympathetic and never failed to help them in their difficulties. The students and the staff of the Agricultural College alike have a genuine regard for him and always speak of him with marked respect. But though they will miss him as their Principal, he will still be amongst them and as Head of the Department will be able to guide and help them in a different but perhaps more effective way.

In the new responsible post, Mr. McDougall's abilities as administrator and organizer will find a fitting scope. He already has the confidence and affection of his colleagues and his long and varied experience will no doubt enable him to rapidly get the department working with the utmost efficiency. We wish Mr. McDougall plenty of luck and success in the new work which lies in front of him.—M.

J. C. Mc DOUGALL, ESQ., M.A., B. Sc

FAREWELL MESSAGE

It is almost 2 years to a day since I took over charge of the post of Director of Agriculture and I write this farewell message to the readers of the College Magazine before leaving to take over the post in the United Provinces recently vacated by one who did so much for Agricultural Education in the Central Provinces.

The last 2 years have been ones of financial strain and the high hopes of expansion which I believed would coincide with my advent as Director of Agriculture have unfortunately not materialized. I do think, however, that with a return to normal financial conditions and with the inauguration of the Reforms, the Agriculture Department will be given a much larger share of the provincial Revenues than it has received in the past. For many years the Department has been struggling to make bricks without straw and I sincerely hope the straw will soon be provided. Every thing is in train for a rapid expansion and all we need now is the wherewithal to expand.

In spite of the adverse conditions of recent years, the Department has continued to show most promising results and every officer has carried out his extra duties without murmur. It has been a real pleasure working with such a body of enthusiasts. Many of the older officers are within reach of retirement and I wish them many years of rest and happiness, a state of mind which should be easy of attainment to men who have done so much for the economic uplift of their fellow countrymen.

The sorrow of leaving the Province is alleviated to a considerable extent by the knowledge that I am handing over the administration of the Department to the capable hands of Mr. McDougall whom you all know, love and revere. I know you will all give him the help and encouragement which I have always received from you and I trust it will not be long before I see the Department expanding to a size more commensurate with the importance of the subject with which it deals.

Everyone connected with the Department should be proud of that connection for it should never be forgotten that it is the only Department of Government which puts money into the pockets of the cultivator and it has already added many crores of rupees to the wealth of the Province. The work of improvement has only just started. Much remains to be done and every delay in adding to the essential staff means an enormous economic loss to the Province.

I bid you all "*au revoir*" for I hope we shall meet again. I leave you with regret for I am not at all happy forsaking the Province which has been my home for 22 years and where I have received so much kindness and help and courtesy. I shall look back always with the greatest pleasure to the many happy days I have spent amongst you, nor shall I ever forget the many kind friends I have made during my sojourn in the Province.

Nagpur,
Dated the 12th Octr. 1935.

J. H. RITCHIE.

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Editorial Notes

THE INDIAN SUGAR INDUSTRY.

The review of the Indian Sugar Industry during 1933-34 by the Sugar Technologist, Imperial Council of Agricultural Research issued as a supplement to the Indian Trade Journal gives a good picture of the rapid strides taken by the industry during the very short period that has elapsed since the imposition of the protective duty. In the general gloom cast over all productive enterprises by the economic depression the sugar industry is the one bright spot. The protective duty has given a great fillip to the industry and it has grown amazingly during the last three years. Prior to 1932-33 there were only 31 cane factories in operation but in 1933-34 there were 123 factories, an increase of 400 per cent in two years. The area under cane in India during 1933-1934 was 3,205,000 acres as against an average of 2,743,000 acres during the preceeding 5 years. The actual area under cane during 1933-34 was slightly less than the previous year but the production of cane, has increased by 3,343,000 tons over the previous year due to the increasing adoption of improved varieties of sugarcane. The production of sugar direct from cane during the year under review was 453,965 tons as against 158,581 tons during 1931-32.

This rapid development of the sugar manufacturing industry in India has dealt a severe blow to Java. The seriousness of the situation can be seen when we consider the fact that India was the most important market for Java sugar, consuming more than

a third of her total production. In 1928 British India imported nearly 11 million metric tons of sugar from Java but in 1933 only 3½ milion tons. Again, in 1926 British India imported as much as 38 per cent of the total production of sugar in Java but in 1932 she took only 19 per cent. The result has been a drastic reduction in the sugar industry of Java. Only 99 factories were in action in Java during the year as against 166 in the preceeding year. The area planted to cane as well as the amount of cane harvested have fallen more than 50 per cent.

The restriction of imports by means of the protective duty has considerably reduced the quantity of sugar available for consumption in the country. The net quantity of sugar available for consumption in 1933-34 was only 881,757 tons as against 1,324,923 tons in 1929-30. This shows that India has to increase her production considerably before she can adequately meet the whole demand of the home market.

During the year under review two important Acts have been passed by the Legislative Assembly, the Sugar (Excise Duty) Act of 1934 and the Sugar Cane Act of 1934. The Sugar Excise Duty Act provides for the imposition and collection of an excise duty on all sugar produced in any factory in British India on or after the 1st April 1935. The Sugar Cane Act is intended to secure to sugar cane growers a fair price for their produce and to regulate the price at which sugar cane which is to be used in the manufacture of sugar may be purchased for use in the factories. This act is now in operation in the whole of the United Provinces and in North Bihar which include 96 factories out of a total of 142 now operating in India. The minimum price of cane is fixed on a sliding scale. A basic price of five annas per maund of cane corresponding to an average price of Rs. 8-8-0 for No. 1 sugar for factory delivery, each rise or fall of eight annas in the price of sugar resulting in a rise or fall of one quarter anna in the minimum price of cane.

The expansion of sugar industry during a period of wide-

spread depression has undoubtedly been of great help to the cultivators of India. It has also resulted in considerable benefit to the United Kingdom whose exports of sugar machinery to India increased from about 26 lakhs in 1931-32 to nearly two crores in 1933-34.

Original Articles

SOME PROBLEMS RELATING TO THE IMPROVEMENT OF THE ORANGE INDUSTRY IN ASSAM,

By N. K. Das, L. Ag. (Hons).

The orange has been long cultivated in Assam in the district of the Khasi and Jaint Hills and in comparatively recent years its cultivation has also extended to other parts of the province, notably in the districts of Sylhet, Kamrup, Sibsagar and Darrang. Large quantities of oranges are now annually exported from all these places. The present economic depression seems to be acting as a stimulus to the growth of the industry and new gardens are being opened every year in various parts of the province. Unfortunately no figures are available to show the actual area under oranges in Assam nor have we got any figures showing the total annual export of the crop. It is, however, needless to say that the orange industry in its present stage is already of considerable importance and that there are immense possibilities of its future expansion. The area of culturable waste land in Assam is over 19 million acres and much of this will be found suitable for the cultivation of fruits.

It is much to be regretted that inspite of the present importance of the orange industry and the prospects that it holds out, it is being run almost entirely on primitive lines. No care, for instance, is exercised by the grower in selecting the material for planting; methods of soil management which would ensure more satisfactory results are but little understood and in the matter of planting and pruning the trees and the handling of the crop, the carelessness evinced by the grower is indeed deploarble. The industry is in need of intelligent guidance and in order that this can be given it is necessary that the various problems relating to the production and marketing of oranges in Assam should first be thoroughly investigated. In this paper it is intended to call attention to

(Paper read at the Sixth session of the Surma Vally Agricultural Officer's Conference held at Sylhet in March, 1935)

some problems relating to the production side of the industry. These will be dealt with under two heads, namely (1) problems bearing on the improvement of the orange plant and (2) Cultural prblems.

Problems bearing on the Improvement of the Orange plant.—It goes without saying that the aim of every orange grower should be to have uniformly good trees in his orchard. It is no use having undesirable trees which would steal the profits. Apparently a very unsatisfactory feature of the orange orchards in Assam is that all the trees in them are raised from seed. A tree like the orange which is naturally cross-pollinated cannot be expected normally to breed true from seed. It is, therefore, highly probable that the seedling progeny of even a good orange tree which combines in it all or most of the desirable characters will show considerable individual variation in regard to vigour of growth, yielding capacity, disease resistance, quality of fruit and such other characters. When orchards are planted with trees raised from seeds borne by different parent plants, as is the case in this province, much greater variation may be expected. This suggests (1) that the propagation of the orange from seed should be given up in favour of propagation by budding and (2) that care should be exercised in selecting the tree or trees from which the bud-wood is taken. These two things are inter-related. There can be practically no meaning in reproducing by budding a tree which inherently lacks those essential characters which are valued by the grower, the consumer and the trade.

This leads us to a consideration of the characters on which the selection of the bud-parent is to be based. Here the problem that confronts the scientific worker is not so simple as it may appear. Very little is at present known in regard to the respective parts played by genetic factors and the influence of environment in determining the various characters of the orange tree. Knowledge on this subject can be gained only by intensive investigation. The difficulty that arises on account of the lack of this knowledge may be illustrated by one or two examples. A worker who discards a particular tree as unsuitable for being used as a bud-parent, simply because certain chracters are not shown by it at a particular time, might be making an error. The missing characters might become fully manifest in the same tree under altered conditions of management or in a different season. There is a strong belief that orange trees grown in soils containing a high percentage of lime yield fruits rich in flavour. If this be a fact, the worker who looks for the same flavour in fruits of trees growig in a soil poor in lime surely

makes a mistake. On the other hand, it would be sheer folly to think that the maximum development of any paticular character could be be achieved by mere management methods. The truth underlying this statement can very well be illustrated by citing an example from animal husbandry. An Assamese cow, however well, she may be cared for and whatever may be the quantity and quality of the food given her, can never under ordinary circumstances equal an Ayrshire cow in milk-yield, nor can she exhibit the same efficiency in the conversion of food into milk. This clearly brings out the importance of genetic factors. In fact the genetic factors reacting on the environment make a living organism what it is.

The question of practical importance that now arises is "how are suitable bud-parents to be selected?" The most practicable method for selection would be to grow a large number of trees at a research station and accurately record for a number of years the performance of each iudividual tree in regard to growth, disease-resistance, yield, quality of fruit and all other characters which may be important to the orange industry as a whole. Such a record is sure to show up some trees which may be suitably used as bud-parents for establishing superior clonal varieties. It can also be expected to provide considerable information as to which of the characters are comparatively more susceptible to the influence of environment and therefore not very likely to be influenced by selection and which are less or not so and can therefore be determined by selection.

In any attempt to select bud-parents for propagation the worker must first of all have in his mind a clear conception of the combination of characters that he would consider ideal. It should be remembered that in regard to some character or characters the requirements of the different interests concerned with the orange industry may be antagonistic. For example, thinness of the rind which is supposed to be associated with a rich flavour in the fruit and therefore desired by the consumer may be incompatible with high-keeping quality desired by the trade. In such cases intelligent compromises will be necessary.

It has already been indicated above that vegetative propagation of the orange is necessary so as to obtain uniform plants having the same genetic constitution as the parent tree. It has, however, been not yet definitely shown that the Assam orange does not generally reproduce itself truly from seed. The chances are that it does not, because the orange is naturally cross-pollinated and should therefore be considered

as heterozygous. When however it is remembered that citrus seeds may produce apogamic seedlings, that is, seedlings which are in reality the vagetative progeny of the parent tree, one naturally feels some hesitation in making a definite statement. This interesting question is worth investigation and its study should be included in any future research programme on the Assam orange. But it should be made clear that whatever may be the result of such investigation the use of budded trees would still be desirable. One reason for this statement is that budded trees bear earlier than seedling trees, and a second one is that the orange is not found to thrive well on its own roots in many localities of Assam.

A budded plant is a combination of a scion and a root-stock each of which represents a different plant. The scion has to depend for its supply of raw food and water on the rootstock. No stretch of imagination is therefore necessary to realise that the performance of the scion will be considerably influenced by the way in which the rootstock functions. It may be stated here, incidentally, that the rootstock cannot alter the genetic make-up of the scion—at least there is no clear evidence to this effect up till now and therefore, for all practical purposes the rootstock may be regarded as an environmental factor to the scion. In order to obtain satisfactory results from a budded orange tree it is not only sufficient to obtain the bud or scion from a selected tree which combines in it all or most of the desirable characters but it is also necessary to use as rootstock some plant which will help the development of the scion charecters to the fullest extent and at the same time ensure a long life to the tree. This will have to be borne in mind in selecting a suitable rootstock for the orange in Assam.

The physiological disease, known as mottled leaf or frenching takes a heavy toll in a large number of our orange orchards. This disease may be induced by a number of different causes. In Bombay draught following a period of abundant water supply is recognised as one of the causes of this disease. It appears highly probable that the long dry weather extending from November to March following a period of abundant rainfall is mainly responsible for its prevalence in this province. Orange orchards in Assam are mostly planted on high-lying or hilly land where the soil is ordinarily rather light and cannot retain sufficient moisture. Over and above this the orange puts forth a new growth about the month of March, which makes a heavy demand on the soil moisture at a time when it is at a minimum. At the Shillong Fruit experiment Station where deciduous fruits are grown on hilly land it has

been found that the weight of the crop varies almost directly as the amount of rain falling during the months of January, February and March. In other words, the moisture content of the soil during these critical months is a limiting factor to the production of fruit in this orchard. If this can be the case in a deciduous orchard how much more the effect of draught should be on orange trees which are evergreen! It is therefore very likely that an insufficient supply of soil moisture during the dry season is the most potent single cause of the mottled leaf disease in our orange groves. The fact that the disease is not so serious in orchards where seepage water from higher land is available—as is the case in the orchards on the southern slopes of the Khasi Hills—lends further support to this conclusion. This suggests that by providing a stock with a comparatively deeper rooting habit the orange could probably be made immune to a great extent from the mottled leaf desease in Assam.

If what has been said above is accepted it is necessary that the root systems of various species of citrus plants should be studied and regular experiments carried out with a view to ascertaining their suitability as rootstocks for the orange.

The next question which arises and the importance of which is not readily realised is " how should the rootstock be propagated ?" At present the use of seedling rootstock for budding the orange seems to be the common practice in commercial orchards all over the world. If the particular species which is to be used as rootstock is found to breed true from seed the question of its vegetative propagation does not arise. Citrus seeds often exhibit what is known as polyembryony. A seed possessing this character will when sown give rise to several seedlings of which only one may be the generative offspring, the rest being produced in a vegetative manner from adventitious buds. The vegetative seedlings will be genetically quite uniform and truly representative of the parent tree. If a clonal variety of the orange is budded on to such seedlings the resulting trees will be perfectly standardised, that is to say, they will exhibit perfect uniformity in all their characters except in so far as these are affected by external conditions. The generative seedlings may be identified and eliminated from the nursery by taking resourse to hybridisation. In case, however, the particular species to be used as rootstock produced only generative seedlings it is rather doubtful if such material can be used successfully for raising uniform budded trees. The use of generative seedlings as rootstocks will introduce factors for variation into the trees themselves. The selection of only the most vigorous

seedlings in the nursery may secure a high degree of efficiency in the budded trees, but on theoritical grounds it does not seem to be very probable that anything like a high degree of uniformity will be achieved in this way. There also appears to be some experimental evidence that trees on vegetatively propagated root-stocks are more uniform than those on seedling rootstocks. A very high degree of uniformity may not be of much practical importance to the grower but it is very important to the experimenter. High variability in horticultural plants is an obstacle in the way of conducting field experiments on modern lines. In western countries, rootstocks for apples are now-a-days being propagated in a vegetative manner for raising experimental trees. There is no reason why a similar procedure should not be adopted, if necessary, for raising uniform budded orange trees for the purpose of field experiments. It should however be mentioned that no suitable method of raising citrus stocks on a large scale in vegetative manner is at present known. But probably the possibilities of investigation in this line are not altogether exhausted.

Cultural Problems.—Problems relating to the management of orchards in Assam are no less important than those relaing to the improvement of the planting material. At present no well-defined method of orchard management is followed in this province. In most of the orchards no cultivation is practically given. The trees are almost invariably planted very close to each other and in the great majority of cases the care of the trees consists merely in cutting down the under-growth from time to time, or in scraping the soil surface once or twice a year to keep down the weeds. Manuring is rarely done and pruning is altogether neglected. In countries where the art of fruit gardening is well developed there are more or less distinct methods of orchard soil management; but it is not known, which of these methods, or what modification thereof, will give the best results under Assam conditions. Experiments are necessary to work out in detail some method or methods which could be profitably adopted in this province. The most important questions which have to be considered in this connection are those relating to :—

(1) the time, frequency and quality of cultivation that should be given;

(2) the maintenance of optimum humus supply in the soil;

(3) the prevention of erosion during the rainy season;

(4) the conservation of a sufficient supply of moisture in the soil during the dry season;

(5) manurial requirements.

As regards the importance of (1) and (2) nothing need be said in particular. The question of the prevention of erosion is very important on account of the fact that we have a high rainfall and that our orchards are frequently situated on sloping land. Reference has already been made to the effect of the long dry period extending from November to March on the orange orchards of the province. The high mortality of the trees due to mottled-leaf is a most discouraging feature of many of our orange orchards. An attempt should therefore be made to control this disease not only by improving the planting material, as has been already suggested, but also by cultural methods calculated to ensure a sufficient supply of moisture in the soil during the dry season. Attention may be called here to the fact that orchards in Assam are not irrigated. It appears that irrigation could be introduced to great advantage in not a few of the existing orchards of the province; but in order that the growers may be induced to do so the benefit to be derived from irrigation has to be demonstrated. The fact the irrigation is not practised at presnt does not necessarily mean that no advantage can be gained from its introduction. Instances are not unknown where cultivators in certain localities of this province have laughed at the suggestion of growing potatoes under irrigation but adopted the practice when its utility was brought home to them by actual demonstration. As regards the importance of the manurial question it may be said that up till now very few, if any, regular manurial experiments on fruits have been carried out in India and that the absence of knowledge on the subject is most regretable. The orange being the most important fruit grown in Assam, it is necessary that experiments should be carried out to obtain reliable information as to its manurial requirements. The belief that the presence of a high percentage of lime in the soil is required for growing high class oranges has already been referred to. Such questions also require elucidation.

The great majority of the orange growers in Assam hold that the orange tree thrives best under a certain amount of shade. In the Khasi and Jaintia Hills the orange is virtually grown under forest conditions. In the plains also it is very frequently grown along with other tall-growing trees so that it gets a partial shade. Whether this shade is essential for the orange under our conditions or is merely tolerated to a certain

extent requires experimental study. The orange is being grown quite successfully without shade in other Indian provinces.

In conclusion, it may be said that it has been possible in this paper to present only some of the important problems relating to the production of oranges in Assam in bare outline. In any scheme of research it will be necessary to consider many lateral issues. The question of the control of various diseases and pests will have to be tackled. The enconmics of the technical methods which may be found to effect improvement of the orange industry will also have to be worked out. Unless practice is based on scientific research no industry can expect to thrive long in the face of present world competition. Apples grown in America are now-a-days being sold in Indian market. Chinese silk is effectively competing against Assam *pat*. Is there any guarantee that our orange industry will not some day come into competition with those of Florida and California?

A GENERAL SURVEY OF THE DIFFERENT VARIETIES OF COTTON GROWN IN BURHANPUR TAHSIL (NIMAR)

By V. G. Vaidya,

(Continued from the previous issue)

Wilt disease and the introduction of Buri—The susceptibility of *roseum* and the *Jari* mixture containing a predominent percentage of *roseum* to wilt led to the introduction of other wilt-resistant varieties. The wilt-disease was detected since long in the Tahsil but the trouble started in earnest in the year 1922. The Department noticed this and introduced some wilt resistant varieties like *buri*, Ak-4 and *bishnoor*. It does not mean that *Buri* was introduced only at that time in the Tahsil. *Buri* was in the *jari* mixture from 1900. It was not sown independently as it was low yielding with a small ginning percentage. Out of the three varieties introduced *buri* was found quite satisfactory as regards wilt resistance, length of staple and market demand and so was distributed in large amounts. As the rise in area under it has been on a progressive scale since then, it will be worth while to know its past history, merits and demerits.

Buri (*Gossypium hirstum*) is an acclimatised Upland Georgian long cultivated in N. Hyderabad and Chota Nagpur. It is comparatively earlier than Upland Georgian, and so gave promising results in Nagpur and Berar where Upland Georgian from Dharwar failed miserably.

in 1874. It is immune to wilt and therefore, met a distinct demand from places where, due to continuous cropping and unsystematised rotation, the disease became serious. This staple cotton gave more yield and higher ginning percentage but has a distinctly weaker fibre than *bani* due to its having been cultivated for about a century. Under the unfavourable soil and climatic conditions obtaining in these parts of India *buri*, though it had done distinctly better than Upland, takes too long to mature to thrive well in years in which the rains cease early. It failed therefore, in 1918-19 in Burhanpur, when it was introduced for the first time, as the rainfall in that year was only 17·66 inches. It does poorly on all but the best soils, requiring as it does more manure and more moisture than our indigenous cottons. It can withstand slight water logging to which *Neglectum* types are most susceptible. In a dry year its lint is weak.

The resistance of *buri* to wilt was well known and so it was not unusual to find wilt affected areas sown with a mixture of *jari* and *buri*. In bad wilt years *buri* at least survived. The Department therefore undertook *buri* seed distribution from 1924 as no wilt resistant strain of *Neglectum* cotton was then known. It would not, however, be compared with *roseum* in point of yield and ginning percentage (Table No. IV) and therefore, was mostly restricted to wilt-affected areas.

The following table will show the seed distribution and area under *buri*.

TABLE VIII.

Year.	Total area.	Seed unions.	Seed distributed in Mds. of 80 lbs.	Acreage estimated, seed rate 13 lbs. per acre.
1922-23	84,155			Introduced.
1923-24	92,113			
1924-25	111,120	4	76 *buri*	
				541
1925-26	112,036	10	15 A. K. 91	1032
1926-27	102,076	12	172	
				2460
1927-28	96,008	11	344 *buri*	2724
1928-29	102,896	24	66 *bishnoor* 410	2040
1929-30	98,972		454	9816
1930-31	92,829		340	—
1931-32	81,111		1636	13375 Approximate.
1932-33	74,171			20000 Approximate.
1933-34	75,905			28500
1934-35	81,031			45000

The above table shows that within 8 years after its introduction its area did not increase over 10,000 acres. In 1929-30 it occupied only 9616 acres as against 71322 acres of *roseum*. The reasons for such slow progress of *buri* in these years were its low yield and small ginning percentage which could not be compensated by the small premium it received over *roseum* in the market. The area under *buri* was not well distributed all over the *Tahsil*. It was more concentrated in Khaknar circle where *roesum* and *jari* suffered more from wilt and water-logging in heavy soils than in Burhanpur and Shahpur circles. Mrs. Ogrady of Majrod ordered for *buri* seed in 1922 for trial on her own farm. It succeeded well on rich soil that was recently reclaimed and where the climate was cool.

The soil and climatic conditions of Khaknar circle are specially suited for *buri* cotton. The soil is clayey loam in character and very fertile. The rainfall varies from 35 to 45 inches and temperature during cotton season ranges from 52°F minimum to 90°F. maximum. Cotton crop usually stands in the field upto the middle of February thus allowing clear 7½ to 8 months period which is quite sufficient for any long stapled cotton. The successful growth under such favourable conditions and wilt resistance made it very popular so much so that during the three or four succeeding years it spread in not less than 40 villages round about Khaknar and Shival. It occupied nearly 12,000 acres out of 30,374 acres under cotton of that circle in 1931-32.

Its spread in Burhanpur and Shahpur circles was not so rapid as in Khaknar circle, for the soils of these circles did not show much wilt. Roseum therefore, continued to be grown till 1931-32.

Era of long stapled cotton (1931 and after)--Buri seed was distributed by the Department only to help the cultivators in getting good outturn on wilt affected areas where *roseum* yielded poorly. Though it is a stapled cotton it is not the standard cotton of the province and so the Department was not keen on extending its area. It was known to be a late maturing and low yielding variety not suitable for C. P. conditions. The distribution of *buri* seed was therefore, stopped as soon as the standard cotton *verum* 262 was introduced on a large scale into the Tahsil. It is reputed to be a medium maturing and wilt resisting long stapled variety (Table No. IV). It affected to a great extent the cultivation of cotton and its marketing in the Tahsil and so deserves a special attention.

Rise and decline of verum.—The new *verum* seed was given out in 1928 mainly on its merits as a wilt resisting long stapled cotton. It was

grown by Deorao Patil of pipalpani on an area of 18 acres. It yielded well and 6 bales of *verum* lint from him were sold at Rs. 380/- per *Khandi.* The rate of local cotton lint was Rs. 265/- thus a premium of Rs. 115/- per *Khandi* was secured, to the grower and on his 3 *Khandis* of lint he got Rs. 345/- more excluding baling and freight charges. This resulted in a demand for *Verum* seed which was grown on 580 acres in the following year. *Roseum* which had maintained a strong footing, so far, in the Tahsil began to lose favour with the cultivators due to the prevalence of wilt and low prices. *Verum* as a wilt resister along with the tempting prices it fetched was therefore, grown by cultivators. The purity of cotton was maintained by roughing alien plants and all the produce obtained was pooled for ginning and disposal. 67 bales obtained in 1929-30 were sold in three lots at rates varying from Rs. 280/- to Rs. 345/- per Khandi and the premium secured on the sale worked out at Rs. 30/- over *Broach* and Rs. 85/- over *Oomra.* It was found out by the farmers that even on areas not affected by wilt its yield, expressed in terms of money value, was much higher than coarser *roseum* or *deshi.* This was due to the premium got for its superior lint, which more than compensated for its lower yield and ginning percentage. This resulted in a keen demand in succeeding years as can be verified from the following table.

TABLE IX.

Year.	Area in Acres.	Bales pooled.	Preimum over *Oomra.*
1928-29	18	6	115
1929-30	580	67	85
1930-31	4447	706	85
1931-32	13598 of Roughed 26400 unroughed.	198	57
1932-33	7000	470	58
1933-34	4245	373	53
1934-35	2998	—	—

The area increased considerably by 1931-32, so much so that it was impossible for the departmental staff to supervise the rouging of the whole of it. The season of 1931-32 was not favourable for *Verum*. Continued rain in the early period made the crop suffer heavily. Nearly 40 to 50 % of the plants died in the first month of their growth, The crop improved in September but a very heavy rainfall of 11 inches in October damaged it. *Roseum* and *buri* were in a better condition than *Verum*. This reacted on the area of the succeeding year, which was 7000 acres only. More interest was taken in *Buri*. The verum crop faired well in 1932-33 but in spite of this it failed to regain its position of the year 1931-32

The reason was that in places of precarious rainfall people took recourse to *Jari* mixture. The mixtures have a certain value in tiding over adverse weather conditions by permitting a strong growth of one type under one set of conditions and another under another set of conditions permitting thereby an average crop.

The premium of Rs.115/-for a *Khandi* of pure *Verum* lint on *Oomra* in 1928-29 fell down to Rs.53/- in 1933-34 and this was, perhaps, also a reason for the failure of pure *Verum*. The small margin between the prices of pure *Verum* and *Jari* was largely due to the *Verum* becoming a more important constituent of the *Jari* mixture (Table No. VI) and thereby improving its quality.

Predominance of Buri from 1932.—The extension of *Verum* was also not uniform throughout the Tahsil. A remarkable increase in area under it could be seen in Burhanpur, and Shahpur circles. It spread very little in Khaknar circle where *buri* maintained a good reputation. Some of the cultivators in Khaknar tract grew *Verum* chiefly because it fetched a higher premium but the yield was so low that they had to abandon it very soon. The climatic conditions of that tract did not suit *Verum*, it being an early variety almost the whole of the area under cotton in Khaknar and Shival tracts is now occupied by *buri*.

In the last 4 or 5 years due to late October showers (Table I) early types of cotton like *Jari*, *roseum* and *verum* suffered much in yield. *Buri* a late maturing and long stapled cotton was therefore, taken up by cultivators of Burhanpur and Shahpur circles also. The late rains allow longer season which suit *buri* cotton. The increase in area from 9816 acres in 1929-30 to 45000 in 1934-35 is mainly due to the successful growth of that cotton under the existing climatic conditions.

Another important reason that has contributed to this rapid spread of *buri* cotton is the gradual preference given to it in the market on account of its long, fine creamy white lint spinning higher counts up to 35'S.

A comparative table for prices obtained by *Buri*, *Deshi*, and *Verum* cottons for the last 5 years clearly would bring this out.

TABLE X.

Rates per Palla of 267.4 lbs. of Kapas.

Variety.	1929-30	1930-31	1931-32	1932-33	1933-34
	Rs.	Rs.	Rs.	Rs.	Rs.
Deshi.	28/- to 32/-	14/- to 16/8-	28/8	19/- to 22/-	16/- to 22/-
Verum.	...	22/- to 23/-	32/-	24/-	20/- to 25/-
Buri.	...	18/- to 20/-	31/-	22/8 to 26/-	21/- to 26/-

This unmistakable tendency in the market for giving higher values to *buri* led to its rapid spread. It is hoped that if such circumstances

TABLE XI.

Year.	Total area under cotton.	*Roseum.*	*Buri.*	*Verum.*	*Deshi.*
1920-21		3162			
1921-22	66495	4590			61545
1922-23	84155	9360			74795
1923-24	92113	12234			79879
1924-25	111120	19548	541		91031
1925-26	112036	24744	1032		86260
1926-27	102076	33408	2460		66208
1927-28	96008	27948	2724		65336
1928-29	102896	34392	2040	18	66446
1929-30	98972	71322	9816	580	17254
1930-31	92829	34560	—	4447	—
1931-32	87111	20088	13375	13598	40050
1932-33	74171	—	20000	7000	—
1933-34	75905	—	28500	4245	43160
1934-35	81031	—	45000	2998	33033

prevail during the coming two or three years all the area under cotton in the Tahsil will be taken up by *buri.*

Resume.—Having traced the history of cotton cultivation in the Tahsil from 1868 to date and studied the different varieties as regards their economic importance, agricultural suitability and fluctuation in area in response to soil and climatic conditions and market demand it is possible to draw certain inferences and make a few remarks. For a comparative study of different varieties the following table showing the distribution of area under different varieties for the last 15 years will be helpful.

Absolute accuracy cannot be claimed for the figures given above, but still they point out certain facts most implicitly. It is at once evident from these data that—(i) the total area under cotton rose upto 112,036 acres in 1925-26 and then fell down slowly to 75000 in the year 1933-34 due to rapid fall in cotton prices. It is hoped that the area may rise if the long stapled cotton replaces the short stapled one. It will then fetch better price and thus encourage the cultivators to bring more area under cotton as is seen during the last two years.

(II) the area under *roseum* increased up to 1928-29 but fell rapidly afterwards to such an extent that there is hardly any pure *roseum* in the Tahsil.

(iii) the area under staple below 6/8" has been rapidly yielding place to stapled cotton.

(iv) the area under *Verum* rose for the first three years and then began to fall rapidly afterwards, showing its unsuitability especially in Khaknar and Shival tracts.

(v) the area under *Buri* is on the increase and the introduction of *Verum* has not affected its spread in any way.

(vi) the area under cotton having staple 6/8" and over is increasing since the last 5-6 years and reached nearly 44% of the total area in 1933-34 and 62 % in 1934-35.

From the above conclusions certain suggestions may be made. It appears from the above fact that as regards the policy which should be followed in the future development of cotton growing it would be unwise to dogmatise but it may be safely said that in each cotton growing tract special attention should be given to those types for the production of which a given tract possesses a natural advantage and that each cotton should at least be a good sample of its type. The constant opportunity

for mutual consultation between representatives of growers, trade and industry is perhaps the best insurance that future opportunities will promptly be grasped.

The agriculture Department has given attention to the increasing area under *Buri* in Khaknar and Shival-tracts and has started some experiments in the direction of introducing the best type of cotton suited to the tracts. Trials of *Buri* Ak special and *Buri* 84 were made in 1933-34 at Burhanpur in cultivators fields and their samples were sent to the Director Technological Laboratory Matunga through the Economic Botanist C. P. for spinning test. Some of the results of the spinning tests have been given in Table No. IV.

In his conclusions he stated that although *Buri* 84 had the advantage of a longer stable it gave the same performance as *Buri* Ak special. Both cottons gave much stronger lint, slightly more neppy yarn than *Buri* local. In the end he mentioned that these varieties are well worth further trials.

Due to increase in rainfall and particularly to showers occurring late in the season *Verum* 262 suffered very much in outturn and growth. The Department is therefore, conducting experiments as regards the suitabilty of late *Verum* but from the experiments so far conducted it has been found to give less yield than *Verum* 262.

A fair trial to these types of stapled cotton during the coming years will decide the suitability of one over the other and also over the existing types.

It may however, be said that these climatic conditions may persist for some years and favour the late maturing varieties. There are probabably cycles of changing weather, one cycle being suited to late types of cotton and another to early ones. So at the end of this cycle old conditions will prevail thereby requiring the introduction of an early type again.

Economic Survey.—One of the most important and difficult questions which now requires attention is that of marketing. The aim in marketing is to secure to the cultivator an adequate price for his cotton. Before dealing with this question so far as it affects the different varieties, it is necessary to discuss the subject of marketing in its more general aspects.

Importance of transport system in marketing.—Transportation is an integral part of marketing and modern commercial development tends every where to enhance the value and importance of good communica-

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tions. Good communications in combination with efficient marketing arrangement operate greatly to the advantage of the producer. Defective communications make marketing more costly as additional charges inherent with it fall upon the shoulder of the cultivator. In short, true income after deducting all costs is larger with more efficient communications.

The roads of the Tashil are metalled and well bridged. The reconstruction of Agra-Bombay road within the tahsil has brought many cultivators in close contact with the Burhanpur local market. The construction of the bridge over the river Tapti has established a good communication between the cotton markets of Berar and Burhanpur. Other roads of the Tahsil are also greatly improved.

The cultivators of the Tahsil sell their Kapas in one of the three markets. Burhanpur, Khandwa and Akola, whichever suits them. The majority of the cultivators bring their kapas to Burhanpur market being situated in the centre of the cotton producing area of the Tahsil. Burhanpur market receives some carts from the adjoining area of Khandesh also. The normal arrival is about 30,000 bales annually. Cultivators of Shival and other villages find it more convenient to carry their *Kapas* to Khandwa as that market often offers better rates on account of lower railway freight. Khandwa market further, is more easily accessible on account of less undulations which permit a better haulage of fully loaded carts. Dedtalai and adjoining villages are nearly equidistant from both Akola and Burhanpur. The cultivators therefore, go where they get better prices. It is estimated that about 1000 carts go every year to each of the markets, Akola and Khandwa.

Sale transactions in the market.—Marketing in C. P. is regulated in all its details by the rules framed by municipal and local market committees and approved by the Government. The markets however, do not work so much in the interest of the producer as would be seen from the following description.

Carts from different places arrive every morning by about 10 or 11 A. M. during the cotton season and are parked in the market place Akbari Sarai in Burhanpur. The seller hands possession of cotton carts to his own *adatya*. The seller may sell direct and thus save commission and some other charges but there is always an apprehension in the mind of the seller that without an *adatya* to champion his cause he would be at the mercy of the buyer in the disputes that are sure to arise and he would be mulcted considerably in allowances and reduction in prices. Moreover

big buyers do not encourage selling without an *adatya* if for no other reason than that an *adatya* brings with him several sellers and considerable clerical work is saved. It is also more convenient to make one single payment to the *adatya* than several small payments to individual sellers who are mostly ignorant and take a lot of time. Another reason why a cultivator engages an *adatya* is that in most cases the buyer makes payment at such a late hour that the cultivator has no time to make purchases with the money. The *adatya* usually gives small advances called bazar advances to the seller when his services are engaged. The *adatya* in the market is thus of great help both to the seller and the buyer and the little amount given as commission is usefully spent.

Market rates are posted on the notice board. Bombay rates are converted into local rates by certain calculations. The Bombay rates are for a *Khandi* of 784 lbs of lint and these are to be converted in terms of the local standard for Kapas transactions, which is a *palla* of 267. 4 lbs. of *Kapas*. The rates quoted are for the best quantity; inferior qualities naturally command lower rates.

At about 10 or 11 A. M. buyers and *adatyas* begin to move about examining samples. In most cases the rates are fixed by auctioning the *Kapas*. The buyers bid for the price taking into consideration the quality and grade. The highest bidder naturally gets the *Kapas*.

In most cases the real bargaining begins when the cart is taken for weighment to the ginning factory nominated by the buyers. It is here that disputes are raised by the buyer. After the disputes are settled and the *Kapas* weighed the *adatya* is paid a lump sum for all the lots purchased through him and this he distributes among the several sellers who

Name of the Company.	Bales.
Ralli Brothers.	6839
Volkart Bros.	2000
Langley and Co	1200
Patel Trading Co.	800
Toyo Menka.	600
Japan Trading Co.	350 average 2000
Tapti Mills.	4800
Ahamadabad Merchants.	7361
Diverted to Khandwa.	500
Total.	24,500

engaged him after deducting his commission and other charges. The buyers then gin the *Kapas* pure or mix several varieties before ginning to prepare a type. They then press the lint to bales and export it. The synopsis on page 65 shows the main buyers at Burhanpur market during 1933-34.

From the description just given of the sale transactions it will be seen that buyers after knowing the Bombay rate auction for the highest rate to be paid to the cultivator for his *Kapas*. After this auction of prices it is only the lucky few among the cultivators who have their cotton regarded as of standard quality. The majority have to agree to a considerable reduction varying from 28-40 lbs. per cart on plea of dirt; dampness, late picking or any excuse that may be invented.

The above is in respect of the large quantities brought to the market. Small quantities have usually to be sold to petty dealers without any expectation of high price.

Marketing of Verum.—Any improved variety lately introduced is likely to be available only in small quantities and it is seldom possible that it could command, in the beginning at any rate, a decent rate unless co-operative sale is effected by collecting different small lots together and grading them for quality. The department undertook such a pooling in the case of *Verum* cotton, as a spinner's cotton like that would with great difficulty command high rate unless it was collected and offered in large bulk. Ordinary *Oomra* and particularly *roseum* could hold the market easily on account of their high ginning percentage a quality easily noticed. Further, this locality is for a long time a recognised market for that variety. The spinner's cottons had not till recently been known to it and to establish their reputation a sort of pooling organisation which means a co-operative sale of small lots collected and graded in big bulk, is necessary. The outstanding merits of Verum *are* that it spins a warp yarn of 18' S to 20'S and upto 26'S maximum. These qualities could be little appreciated in the usual market established pre-eminently for ginner buyers. Its reputation as a spinning cotton had to be established by proper examination and certification. This obtaining of a certificate of quality is more easy for a pool organisation than for an individual cultivator since the pools are run by more responsible persons.

Demand for Buri cotton.—There has, of late years, been a rising demand for *Buri* cotton at higher prices from Cawnpore and Ahamadabad mills. usually produce finer piece goods. The Tapti mills and some other mills in C. P. and Berar have not yet specialised in finer piece goods and they still

make a demand for a less fine but stronger variety of cotton like *Verum.* Burhanpur and Khandwa are better placed for sending their cotton to Ahamadabad and Cawnpore than other parts in C. P. and Berar, and the success obtained by *Buri* cotton in certain areas of Burhanpur Tahsil keep it in a position to supply this long and fine stapled cotton to the Ahamadabad and Cawnpore mills.

Marketing of Buri cotton.—*Buri* cotton is sold in the market under the trade name *Buri.* It has earned a name in Bombay market and is offered a higher price than local *deshi* cotton (Table No. X). It is liked by the mill-owners for its creamy, white lint and long staple. At present it is sold in the market as *Oomra* cotton. Every year several merchants from Ahamadabad and Cawnpore come to purchase *Buri* cotton. They mix it with *roseum* and a small amount of *Verum* before ginning to prepare a type, which they sell under the name of *Buri.* In this way they admixture coarse cotton with fine cotton like *Buri* and gain huge profits. There is no co-operative method of marketing for this cotton. The chief features of this cotton are that it spins upto 35, S. The *Verum* pool created a taste for the stapled cotton in the market and *Buri* which is superior in this respect naturally was better respected, and obtained higher prices in the open market, than the local Oomras. It is possible that by pooling it may be offered even higher prices. This cotton further offers better facilities for pooling as it is grown in more concentrated areas than its predecessor *Verum*

From the arrival of different cottons in Burhanpur market during the year 1933-34 the increase in area under *Buri* could be well proved. The arrivals in the market for the different cottons are:—

Deshi cotton	15500 bales.
Buri ,,	8000 ,,
Verum ,,	1000 ,,
Total.	24000 bales.

A further rise in the arrival of *Buri* cotton in the market is expected this year (1934). A still better stimulus could be given to the increase in its area by pooling and thus obtaining better prices.

Conclusion.—Burhanpur Tahsil has broadly speaking two distinct tracts with their own special characteristics. The first tract includes Khaknar circle and Shival and its surrounding villages. The soils are almost virgin and retentive in character and the rainfall is high and extends to the end of October. It is suited to long stapled late maturing cotton like

Buri as has been found since 1922. The total area under cotton in this tract is near about 35,000 acres.

The second tract comprises Shahpur circle and a major portion of Burhanpur circle. The soils are lighter in character than those of the first tract. The average rainfall is low and generally ceases by the end of September. It is a tract specially suited to early maturing cottons. *Verum* can be grown successfully in years when rains stop by the end of September or early in October.

Since the last five or six years there is a higher rainfall with late October showers in this tract. It is because of this reason that *Verum* failed and *Buri* succeeded. If such climate continues *Buri* will be grown all over the Tahsil and if the normal conditions resume it will be more or less restricted to Khaknar tract. Burhanpur tract will then require an early type.

Certain improvements in *buri* cotton are necessary. They may be stated as follows :—

(*i*) Selection for a comparatively early strain of *Buri* to avoid damage from frost.

(*ii*) Selection for a strain having stronger staple.

(*iii*) Selection for a high yielding strain with better gining percentrge.

If the above improvements are attained and added to the qualities existing in *Buri*, the cultivators of the whole of the Tahsil and especially of Khaknar circle will be greatly benefited. It is necessary to carry on some breeding work in the Tahsil itself, to ensure success.

The trade is slowly giving preference to quality staple. There is a great demand for stapled cotton from Indian mills and the market offers decent premium for it over short stapled cotton. The premium offered usually maintains its superiority in money value even in bad years. This in itself is a sufficient inducement for cultivators to put in more acreage under fine cotton.

Co-operative marketing of Buri cotton on the lines of the *Verum* pool will bring in higher money returns and improve the financial condition of the cultivators. At present the main purchasers of Buri cotton are Ahamadabad and Cawnpore mills. Some merchants from Ahmadabad and Cawnpore come every year to Burhanpur. They purchase *Buri*

cotton mix it with Jari and Verum and prepare a type. They then transact with the mill owners and make profit. It is recommended that pool organisation should undertake direct negotiations with Ahmadabad and Cawnpore mills to save commission gained by middlemen.

One of the activities of the Agriculture Department is to root out coarse cottons. Attempts were made in the past and are being made at present, to replace short stapled cottons by long stapled varieties in the Tahsil and elsewhere. They have met with little success in other parts of C. P. and Berar. Burhanpur Tahsil however, offers very bright chances in this direction. There are already 47,298 acres out of 81,031 acres under long stapled cottons. If the above recommendations are brought into effect it may be definitely said that Burhanpur Tahsil will grow only long stapled cottons within three or four years.

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Extracts

THE CONTRIBUTION OF ROTHAMSTED TO SOIL PHYSICS.*

B. A. KEEN.

Until 1913 no systematic work on the physical properties of soil had been done at Rothamsted or indeed in Great Britain. The investigations were suspended during the War and resumed in 1919. Most of the publications of the Physical Department fall conveniently into a few groups, and these have been utilised, rather than a chronological order of papers, in the short account that follows A full discussion will be found in the Rothamsted Monograph entitled "The Physical Properties of the Soil."

Mechanical Analysis.—The methods of mechanical analysis have been developed in two main directions: existing methods based on the separation into a few groups of fraction have been improved both in simplicity and accuracy ; and much attention has been paid to the elegant procedure, first evolved by Oden in Sweden, by which a particle size distribution curve is obtained.

In Great Britain a co-operative investigation was organized from Rothamsted to test the suitability of two important improvements devised by Robinson of Nangor, Wales : pre-treatment of the sample with hydrogen peroxide to remove organic matter, and the substitution of pipette sampling for separation by sedimentation. Two reports were issued, recommending for official adoption in Great Britain the use of hydrogen peroxide in the pre-treatment of the sample, and the employment of the pipette for determining the percentage of the silt and clay fractions. The new method was subsequently adopted, with a minor modification, as the Official Method A of the International Society of Soil Science. Thus, the International and British methods of mechanical analysis are identical, except for one minor difference. In changing their method, British workers were faced with many difficulties in preserving continuity with the extensive results accumulated by the older methods; but the internatinal character of soil science, and the ultimate advantages of a generally accepted universal method, were considered to have overriding importance. An appeal was made to all soil workers to take similar action, with little or no effect.

In the International and British methods, as in many others, a fine mesh wire gauze sieve is used to separate the coarse sand. The gauze

* Report of the Rothamsted Experimental Station Harpenden' for 1934.

stretches gradually with use, and the originally plane surface becomes bowl-shaped; in addition the warp and weft wires undergo relative movements which produce mesh apertures both larger and smaller than the original ones. A mathematical and experimental examination of these two factors showed that no serious error was probable until the sieve had become badly worn.

Oden's method is based on the measurement of the progressively changing density or hydrostatic pressure during the sedimentation of a suspension. The particles settle on a pan immersed in the suspension and the increase in weight is recorded at intervals. Evidently it is desirable that these intervals should be as short as possible: in other words, the balance should be automatic and continuous recording. A balance fulfilling these requirements was developed by the Physical Department at Oden's suggestion. An apparatus which gives a continuous record of weight changes has, of course, uses beyond mechanical analysis; this was demonstrated in an interesting way during the final trials of the apparatus, when a discontinuity in the dehydration of certain salt hydrates was discovered. Further work with the apparatus in an attempt to eliminate a discrepancy between the calculated and actual final weight caught by the pan, led to the disconcerting discovery of an inherent defect in the Oden procedure and, indeed, in every other method of obtaining size distribution curves. The error arises because any attempt to measure changes of density or hydrostatic pressure in a sedimenting suspension is bound to disturb in a complex fashion the very factor it is desired to measure. Thus, in Odens method, the pan shields the liquid below it from the descent of particles, while the liquid in the annular space around the pan is not so shielded, and a density difference is set up between them. Intercharge of suspension between these two regions inevitably occurs, which interferes with the free vertical fall of the particles and destroys the fundamental assumption on which the mathematical analysis is based. Many experiments were made in the hope of removing the trouble, or at least reducing it to a systematic error, without success. Although this seriously limits the use of these methods for purposes of research, they are useful for specifying rapidly the approximate mechanical analysis of a soil. An exceedingly convenient and quick method has been devised which gives, in effect, the time rate of change of the excess density of the suspension at a given fixed point. The readings of the monometer are then directly proportional to the summation curve, and only one differentiation is needed to obtain the distribution curve instead of two, as in Oden's

method. The apparatus is particularly suitable for giving summation curves for the coarser fractions of soils, and for sandy soils, and is apparently accurate to within 2.3 per cent.

Soil properties concerned in clutivation.—The mechanical properties of soil likely to be of importance in cultivation have been discussed by numerous workers, and especially by Atterberg. Certain of his methods were re-examined in the Physical Department, in particular his cohesion test. Atterberg found abrupt changes in direction of the curves connecting cohesion and moisture content and used the position of these breaks for classifying the field behaviour of different soils. However, our experimental irregularities were too great to confirm the existence of the breaks although soils of widely differing properties were employed. The cohesion forces were ascribed in the main to the surface tension of the continued water in the minute interstices and points of contact of the soil grains, and it appeared that the electrical resistance of soil blocks might throw light on the water distribution. Some preliminary measurements gave wide differences between different soils; later, a more elaborate investigation showed that the nature of the electrode and the rate the blocks dried had considerable effect, but four characteristic breaks in the curve were found, two of which were readily identified, by separate experiments, with Atterberg's "Asrollgrenze" (the lower plastic limit) and the "Schwindungsgrenze" (moisture content at which air enters the pores) while the two lower ones were hitherto unrecorded.

In work of this kind much confusion will arise unless the full difference between natural soil and the simplified "ideal" soil, consisting of equal sized spheres, uniformly packed and free from colloidal material is very clearly kept in mind. The volume shrinkage of moist soil blocks as drying proceeds takes place in two stages. At first the volume shrinkage is exactly equal to the volume of water evaporated, but later, as the grains come closer together, the shrinkage is smaller, although still linear. In the case of materials that are free from a colloidal or gel-like coating this second stage is absent, and no warping occurs in the later stages of drying, and differential stresses which lead to rupture of the blocks on remoistening are absent. In the case of natural soils, however, such stresses are instrumental in the disintegration by weather of the large lumps of soil left by autumn ploughing.

"Single value" measurements.—Attempts by many workers have been made to assess the general character of a soil by measuring one property, or group of properties, thus specifying the soil by a single number

(or "single value") in place of the group of figures given by a mechanical analysis. The underlying idea is that such a "single value" would place the soils in an order that closely reflects their field behaviour. The Physical Department has given much attention to this problem and has tested many of the suggested methods on a wide range of soils. The methods were chosen as for as possible from those requiring only simple apparatus. The measurements were repeated after the soils had been treated with hydrogen peroxide, to obtain some idea of the contribution of organic matter to the result. A preliminary examination showed that certain methods gave highly correlated results, presumably because they were measuring the same, or closely related physical properties. At a latter stage, a full statistical examination was carried out on extensive data for Natal soils, obtained in Mr. J. R. H. Coutts' experiments. It was shown that from a knowledge of the base exchange capacity of the soil, a good prediction could be made of the sticky point, the moisture content at 50 per cent. relative humidity, and the weight of water held by the saturated soil; the clay content on the other hand, was of minor importance in predicting these properties but, in conjunction with the silt content, it was closely related to the xylene equivalent. The xylene equivalent-which is obtained by using xylene in the moisture equivalent apparatus instead of water—is of interest: it measures a soil property that is independent of the organic matter present, for it can be almost completely predicted from other measurements made on the soil after treatment with hydrogen peroxide. The net result of the statistical examination of this series of Natal soils was to show that certain single-value measurements were controlled by the base exchange capacity, while others depended more on the content of clay and silt. How far this generalisation may apply to a wider range of soil types is uncertain. Some departure is to be expected; for example, the loss on ignition of the natural and peroxide treated soils of the Natal series gave results of no great importance, whereas the inherent fertility of a series of Malayan rubber soils was reasonably well predicted by the ignition loss of the soils and of the clay fractions.

The relationships become more diffuse when single-value measurements are considered as an aid in distinguishing one soil type from another. Ideally, one would desire to obtain very good correlation between two different measurements when done on soils from the same type and to find that the regression constants of the curve connecting these two measurements varied with the soil type. Up to the present it appears that within a broad soil-type the sub-types are suffi-

ciently variable to affect the correlation between the measurements; it may, therefore, be that a soil type will not be characterised by regression constants of a curve connecting two measurements, but by an area on the diagram.

Four other single-value measurements that fall somewhat apart from the main line of argument developed above may be briefly mentioned.

An interesting method of measuring soil fertility developed by Atkins has been studied. The electrical conductivity of a soil suspension is measured and the increase in conductivity after a fixed period (seven days) is taken as an index of the biological activity in the soil, and therefore of its inherent fertility. The method was applied to soil samples taken in the past from the classical plots and stored in the air-dry condition; the increase in conductivity of the suspensions made from these samples fall in the same order as the corresponding crop-yields in the year of sampling. The method might repay an extended trial as a sample qualitative measurement of soil fertility.

The so-called hygroscopic co-efficient, which has been much used in America as a single- value measurement for soils was subjected to critical examination and found to be unamenable to accurate measurement. The conception of a hygroscopic co-efficient is, in fact, fundamentally unsound; the moisture content at 50 per cent. relative humidity is much to be preferred.

The heat-of-wetting measurement was introduced by Mitscherlich as an index of soil heaviness, but subsequently abandoned in favour of a hygroscopicity determination. Recently, refinements have been introduced in the method, and the results seem, in certain circumstances, to be related to the physical condition of the soil, and to be correlated with other soil properties determined in the field or by laboratory methods. Experiments on pure single-base clays gave the interesting result that the heat-of-wetting represents a specific proportion of the heat-of-hydration of the absorbed cations in their free state.

Returning to the question of soil heaviness, a new method has been developed which gaves a satisfactory and rapid laboratory measure of this factor. A plastic cylinder of the soil is rolled backwards and forwards between two plates and the weight on the upper plate is slowly increased until it exerts a certain critical stress which causes the cylinder to lengthen.

Clay aggregates and tilth.—The phenomenon of crump, or compound particle, formation in soils is well known to all practical men; their cultivation methods are designed to produce this aggregation, to which the term "good tilth" is generally applied. Although good tilth is at once apparent to visual inspection, explanations in scientific terms are almost completely non-existant, and most text-books give only the attractive but strained analogy with the flocculation and deflocculation of weak clay suspensions. The subject has recently been taken up in the physical Department and, for the first time, a satisfactory explanation of the main factors concerned in the process of tilth formation has been given.

It has been shown that clay particles can form strong aggregates, or crumbs, when dry, only if the clay particles are sufficiently small, if there are a sufficient number of small exchangeable ions on the clay, and if the clay has been dried from a dispersion medium whose molecules are polar and sufficiently small.

An hypothesis in accordance with the experimental results is that cations can orientate polar molecules of the dispersion liquid around them with a power proportional to their surface density of change; this power is also possessed by the free negative charges on the clay particle, so that when the dispersion liquid has nearly all been removed, (i. e. when the soil or clay has dried appreciably) the cations bind the negative charges on two clay particles together by means of bridges of strongly orientated molecules of the polar dispersion liquid.

. **Soil cultivation.**—When an implement is drawn through the soil its resistance is determined by two groups of factors relating to the design and construction of the implement itself and the physical properties of the soil. The group belonging to the implement lie within the province of agricultural engineering and from the subject of study at another Institution; only incidental references will be made to them here. The second group—the soil factors—exert their influence through such properties as soil cohesion, plasticity and friction. They are susceptible to laboratory examination, and instances of their relation to the behaviour of soil during cultivation have been given in the preceding sections. The soil resistance to cultivation is a kind of integrated effect of numerous physical properties; hence, the study of soil resistance has considerable scientific as well as practical interest. The field experiments have taken both these aspects into account: the growth and response of farm crops

to different systems of cultivation has been investigated as well as the relation between the cultivation systems and the soil properties.

It was necessary to evolve a dynamometer that would give a continuous trace of soil resistance, together with necessory measurements such as speed and depth of cultivation. For some time, a modified form of a dynamometer designed for road-traction measurements was used. The instrument gave quite satisfactory service, bnt the recording system needed skilled attention, and, owing to its weight, the dynamometer was not suitable for tests with the lighter forms of cultivation. A new type was therefore constructed, based on the "Strees Recorder" made by the Cambridge Scientific Instrument Company. The new instrument is much lighter than the old one, and the records are impressed in the form of a grave on a narrow ribbon of celluloid by styluses with hard points The celluloid is not scratched but flows under the pressure of the point; the groove has excellent optical properties so that a greatly magnified copy can be obtained in the ordinary way. In addition to the trace of soil resistance, a time scale is impressed automatically on the ribbon, and the operator carries a tapping key connected to an electro-magnetic stylus, so that notes in the Morse code can be also impressed on the ribbon. This last feature is of great use, since it obviates the risk of confusion in examining the records of cultivation when a complicated set of plots is being cultivated.

The dynamometer was used in a series of investigations, and the main conclusions are summarised below. One very interesting and unexpected result was to demonstrate the heterogenity of soil. A field that was judged by practical farmers to be quite uniform in its soil properties showed the most surprising changes in soil resistance from point to point. These variations-which are reflections of corresponding variations in the inherent soil properties-are substantially permanent: the magnitude of the soil resistance depends, of course, on the season of cultivation, the kind of implement, its depth of work, etc., but the relative fluctuations of soil resistance from point to point are not affected. Heavy applications of artificial manures and the long continued differences in crop yields of the classical Rothamsted plots have not produced any appreciable modification of the original and inherent heterogeneity of the soil, with the exception of plots receiving a heavy dressing of dung or of chalk, where, as would be expected, there is a definite lowering of the soil resistance. The inherent variations in soil resistance, disclosed by the dynamometer during soil cultivation with implements, change slowly from

point to point. The question whether these changes were themselves average values of larger and more rapid fluctuations within distances of a few inches was examined with another instrument which measures the force needed to drive a vertical rod into the soil; the instrument is, in principal, a miniature pile-driver. Wide variations of resistance were found between points whose horizontal distance apart was only 6 ins. The large and small scale heterogeneity thus demonstrated is one of the reasons for the modern statistical arrangement of field plots which was described at length in last year's Report.

A result of considerable practical importance is that soil resistance increases only slowly with speed of cultivation. The design of cultivation implements is of necessity a compromise between numerous conflicting requirements, but the farmer requires the maximum speed of travel, and it is important to note that the possibility of increased soil resistance at higher speeds can be ignored.

One means of reducing the soil.resistance at higher speed has been demonstrated both in the laboratory and in full-scale practical trials. The soil colloids carry a negative charge, hence under the action of an electric current water will move through the soil and be deposited on the negative electrode. If the mould-board of a plough is insulated from the frame, and made the negative electrode, a film of water will be deposited on it, and the fractional resistance of the furrow slice passing over the mould-board will be reduced. Measureable reductions of draft were obtained in field trials with an improvised and inefficient arrangement, and the method deserves commercial attention. It is likely to be of considerable use on soils that do not scour easily. The "gumbo" soils of Mexico are a well-known example and instances of English soils in Northamptonshire and Lincolnshire have also been observed. In the latter cases the probable cause is a high percentage of silt in the soil.

The effect of different methods of cultivation has also been studied at Rothamsted. The immediate disintegration of soils by implements has been investigated by passing blocks of soil before and after cultivation through a series of sieves with mesh sizes varying from 1½ ins. square to 1/10 in. and comparing the percentages of the original sample left on the sieves. The kind of tilth produced by spring ploughing or cultivation is much more controlled by the weather of the previous winter than by the intensity of the spring treatment. In the case of summer cultivations, e. g., hoeing between root crops, there is a strong suggestion that extra cultivations

above those necessary to kill weeds, are without benefit to the final yield and may even lead to appreciable reduction, but further experiments in a variety of seasons will be made before a final conclusion is given, Much attention has been given to rotary cultivation. In this method the soil is acted upon by rotating tines and it is claimed that a seed-bed can be produced in one operation, in place of the series that is needed with the traditional range of implements. The main purpose of these experiments is to ascertain if the method is suitable for arable agriculture on medium and heavy soils, which are commonly stated by practical men to require careful and skilled cultivations if a good tilth is to be secured. One of their objections to rotary cultivation is that it gives too fine a tilth. The sieving method described above shows this is not the case; the tilth is no finer than that obtained with the ordinary implements. It is however, much looser, and the methods for dealing with this new condition and turning it to advantage are still being worked out. In the early stages of growth a rotary cultivation tilth is superior to the normal type; germination and early growth are both better, and although the advantage is usually lost by harvest time, the final yields are usually as good as those given by normal cultivations. This result is obtained in spite of the extra weediness of rotary cultivated plots, which is probably a consequence of the action of the rotating tines. The weed seeds are distributed throughout the depth of cultivation whereas the normal methods encourage germination only in the thin surface layer, where hoeing can easily deal with them.

If these technical difficulties of rotary cultivation can be overcome, the way is clear for an appreciable reduction in the heavy costs of cultivations that the arable farmer must face. The field experiments are therefore being actively continued.

CLIMATE IN RELATION TO INSECT POPULATION.*

The very rapid rate at which insects are capable of increasing in numbers is a matter of common knowledge. Linneaus was probably the first to call attention to this, when he wrote that "three flies can consume the carcass of a horse as quickly as a lion." The present writer has remarked that a single individual of the common coffee mealy-bug in Kenya is theoretically capable of producing forty thousand million tons

*Extracted from "The Climate and Eco-climates of Coffee Plantations" by T. W. Kirkpatric, M. A. Dip., Agric. F. R. E. S. (Entomologist, East African Research Station, Amani, Tanganyika,) 1935.

of mealy-bugs by the end of one year. The factors limiting such fantastic rates of reproduction are absence of sufficient or suitable food, predators, parasites and diseases, and unfavourable climate conditions. In the first instance mentioned, that of flesh-flies devouring a carcass, none of these factors may have much controlling value, and while the food supply lasts something approaching maximum rate of reproduction may in fact occur. In the case of a phytophagous insect, shortage of food soon becomes effective in limiting or entirely stopping the increase in numbers, but not, in the absence of other controlling agencies, until such time as the host plant has been severely damaged, If, therefore, such damage is to be avoided, it is (apart from such purely artificial methods of control as insecticides) to the other factors-predators, parasites and diseases, and probably even more so to climatic conditions-that our attention must be turned. It is not here necessary to discuss in detail the effects of climate on the abundance of insects a summary of the comparatively little that is so for known about this subject has been given by Avarov, It will, however, be advisable to call attention to the fact that the numbers of a species are regulated not only by the lethal results of extreme weather conditions but perhaps even more so by the cumulative effects on mortality of quite small climatic variations. A simple hypothetical case will illustrate this point. Suppose that an insect of which the proportion of the sexes is equal, when living in one habitat lays an average of 100 eggs per female, 50 per cent. of these eggs are parasistised, those that hatch require 30 days to arrive at maturity, and the average daily mortality is 5 per cent. (of the survivors on any given day) from predators, disease, etc., and 5½ per cent from climatic causes. Only two individuals will under these circumstances survive to the adult stage and the numbers will therefore remain constant. Now let us assume that the same insect also lives in a habitat of which the eco-climate is slightly more favourable, and that here each female lays an average of 106 eggs, that the same proportion (50 per cent) is parasistised, and that there is the same daily loss from predators, etc. (5 per cent). If the daily mortality from climatic causes in this habitat is 4 per cent. instead of 5½ per cent. aud the number of days required for growth 28 instead of 30, the number of the offspring of a single pair that will arrive at maturity will be four, and the population will therefore double itself with each generation. Again, to illustrate the cumulative effect of still smaller variations, let us consider the case of a parthenogenetic insect such as a mealy-bug, that in one habitat lays 100 eggs and requires 36 days for its complete life cycle. If the average daily mortality from all causes is 12

1/3 per cent of those still surviving, the population will remain stationery. If, however, in another habitat the average number of eggs laid is increased by 5 to 105, and the time required for the life-cycle reduced by one day to 35 days, even if the mortality remains the same, viz. 12½ per cent per day, each generation will increase in number by 20 per cent. and after ten generations, i.e., less than a year, the population will have multiplied itself six-fold, From such scanty data as are available it would appear certain that at least with many species of insects-the variations in eco-climatic conditions required to produce differential rates of increase such as those in the above two examples are very much less than the variations that may in fact be found in two habitats only a few yards apart.

In connection with the foregoing statements, some comment on a recent paper by A.J. Nicholson appears to be desirable. The author denies the widely accepted theory that climate is in many cases responsible for controlling an insect, and states that,, the importance of a factor in controlling a pest is not even suggested by the fraction of pests it destroys. When searching for the control factors it is necessary to find which are influenced, and how readily they are influenced. by changes in the density of the pest," and again "Physical factors that are uninfluenced by the densities of animals cannot directly determine these densities."

If this were literally true, all the money at present spent on insecticides is being wasted.

Space does not permit of a complete discussion of this paper, but it is tempting to add to the two hypothetical cases of climatic control given above two actual instances, so that the reader can judge for himself whether or not direct control of a pest by climate is a reality.

(1) It is a matter of common knowledge in East Africa that the Coffee Thrips (*Physothrips xanthoceros* Hood) only resumes the proportions of a pest during a prolonged period of dry weather, and that the early onset of the rains, or even a spell of cool and rainy weather during the normally warm and dry season, will, reduce the density of the pest to a point at which the economic damage caused is negligible" (the quotation is from Nicholson's own excellent definition of the function of economic control). It will scarcely be asserted that the rainfall of a given week is dependent on the number of Thrips present, or that the severity of the action of the unfavourable weather increases with the initial densityof the Thrips.

(2) Take the case of *Oxycarenus byalinipennis* Costa. This insect appears to have no parasites or predators, it increases in numbers rapidly

for about four months of the year, during the remaining eight months there is an enormous destruction which has been shown to be due solely to climatic causes. If this destruction did not take place there would be some 20 million bugs to each acre of cotton at the beginning of the breeding season, instead of only 100,000 or so. It is true that after a very few seasons the population would reach a steady density, being controlled by the limitation of the food supply but not until almost every cotton seed had been destroyed. In this case also there appears to be no confusion of thought between the destruction (caused by climate) and control. Indeed as already suggested the limitation of the food supply can probably never secure the economic control of a phytophagous pest, as it does not come into action until severe damage has been done.

Let us consider the hypothetical, but quite possible, example which Nicholson gives to illustrate the distinction he draws between destruction and control. He supposes an animal that " would increase one hundred-fold in each generation if unchecked, and also that, on the average, climate destroys 98 per cent of the animals. It is clear that the number of animals would be doubled in each successive generation if no other factors operated. Climate could never check this progressive increase, for it would continue to destroy only 98 per cent its action being uninfluenced by the density of the animals. If, however, there is some other factor, such as a natural enemy the action of which is governed by the density of animals, the destruction of the remaining 1 per cent necessary to check increase would soon be accomplished. If this example were observed in nature, one would be tempted to conclude that, because climate destroys 98 per cent. of the animals while the natural enemy destroys only I per cent. The limitation of the population is mainly due to the influence of climate. However, it is clear that the natural enemy is wholly responsible for control, because climate, by itself would permit the density of the population to become indefinitely great. " For one interpretation of the word " control " the above is perfectly true, remove the natural enemy from this situation and the pest will increase (given of course an unlimited food supply) indefinitely. But in the absence of other controlling factors, a natural enemy of which the power of increase is less than that of its host" will never subjugate the host unless its initial population is much larger in relation to that of the host than is ever the case in any practical undertaking." For let it be assumed that Nicholson's example is that of a parthenogenetic scale-insect producing 100 young in each generation, and attacked by a parthenogentic parasite laying 50 eggs, and never more than one in each host and having the same number of generations annually as

its host. With a 98 per cent destruction of the host from climatic cause, it is clear that on the average one host and one parasite will survive each generation, and balance be maintained. This appears to comply with the postulates, and it is agreed that if the parasite disappears the numbers of the scale-insect will be doubled with each generation until they increase to infinity, in spite of the climatic destruction. But if the destruction caused by climate were removed, the increase would be fifty fold instead of twofold in each generation (for the parasite laying 50 eggs could never unaided catch up with the host laying 100,) and though theoretically it will be just as long before infinity is reached that will be small consolation to the farmer on whose plantation a pest is increasing rapidly instead of slowly.

Circumstances undoubtebly exist in which the destruction of even large numbers of a pest by means such as insecticides (and possibly climate) does not secure control, and may even be followed by increase in the density of the pest. This was shown by the present writer to be the case with the Coffee Mealy-bug (*Pseudococcus licacinus* Ckll.) in Kenya. Although at the time (1927) this view did not meet with much acceptance and further large-scale experiments with sprays were made, the results of these were entirely confirmatory.

But to say that such a state of affairs is inevitable, and that "any factor having the necessary property for the control of populations must be some form of competition" is clearly not to accord with facts.

The fallacy appears to lie chiefly in the confusion between control of density by balance, for which it is true that" the action of the controlling factor must be governed by the density of the population control and the control in the ordinary sense of the word. i.,e., reduction of the density to a point at which the economic damage caused is negligble," which can be equally well effected by factors, such as climate, which are in no way governed by the density of the population.

COTTON, CHARACTERS OF A SUPERIOR VARIETY.*

By C. B. Doyle.

From the standpoint of the cotton growers, the characters of a superior variety of cotton are early maturity; medium to light foliage; large, storm-proof bolls, many with five locks and easy to pick; large yield per acre; high lint percentage; and abundance of fiber of good length, strength, and uniformity, on large heavy seeds that germinate well.

Small-bolled varieties may begin blooming and setting fruit a few days earlier than the big-bolled cottons, but early varieties with big bolls

* The Yearbook of Agriculture, 1938", U. S. Dept. of Agriculture.

that frequently set more fruit during the first 40 days of the fruiting period than the small-bolled cottons, have been developed. Also big-bolled varieties usually continue fruiting over a longer period than do the small, bolled cottons, which is also an advantage, because the weevils are attracted away from the growing bolls to the tender squares.

Most cotton varieties with small bolls appear in the field to be more productive than varieties with large bolls. This is due largely to the fact that most of the small-bolled varieties have short fiber. The bolls frequently open more widely and allow the cotton to fluff out from the locks. On account of their thinner walls, the small bolls dry out more quickly and usually open several days sooner than the thicker-walled bolls of the big bolled varieties, though the latter will become immune to boll-weevil punctures sooner than the small bolls.

The increased planting of small-bolled varieties after the invasion of the boll-weevil was largely the result of the popular idea that such varieties offered the best prospect of profitable production under weevil conditions. But there is ample evidence to show that equal or larger yields can be obtained from well-selected big-bolled varieties under most of the conditions that prevail in the Cotton Belt. Along the northern rim of the belt, where the seasons are shorter, better average results may be expected from varieties with somewhat smaller bolls. Also, in the more humid districts, difficulties may be encountered in wet seasons with varieties having very large bolls requiring a longer period to dry out and open.

From a practical standpoint an important economic advantage for the big-bolled varieties comes in the harvest season. Since it requires about the same length of time to pick 100 small bolls as it does to pick 100 large bolls, and since the latter weigh from 25 to 50 per cent more than the former, pickers can gather the big-bolled crop much more quickly and cleanly, thus obtaining higher average grades at less cost.

The popular belief that a higher percentage of lint proves the superiority of a variety has cost American cotton growers many millions of dollars annually and has led to further deterioration of varieties, rather than to improvement. High lint percentage gives no assurance of large yields per acre, but may be the result of smaller or lighter seeds and may characterise weak or unproductive varieties.

The custom of evaluating a variety of cotton by percentage of lint should not give the farmer the idea that the lint percentage is a true

standard for judging varieties for planting. The practical question of how to produce the most fiber per acre has no relation to the percentage of lint obtained from a wagon-load of seed cotton at the gin.

The farmer must consider the lint percentage in relation to other questions of practical importance such as the size and weight of the seeds the earliness and yield of the variety and the length and quality of the fiber. It is only when these other qualities are maintained that the higher lint percentage can be accepted as evidence of superiority in a variety or specially selected strain.

The safest and most effective way to judge the merits of a cotton variety is to know, in addition to the lint percentage, the lint index which is the amount of fiber on 100 seeds. An increase in the weight of fiber on 100 seeds is associated with an increase in the weight of the seeds and fewer bolls of such cotton are required to produce a pound of fiber. Thus the lint index is an important factor in the cost of production, because any increase in the weight of fiber from 100 seeds without change in the percentage of lint reduces the labour of picking and thereby increases the efficiency of the pickers. Varieties with high lint percentage should not be selected unless they have the other desirable qualities.

Uniformity in length is one of the important factors in the spinning quality of cotton fibers. The ideal cotton, therefore, from the standpoint of the spinners and manufacturers, would probably have all the fibers of one length. But, unfortunately, uniformity in cotton fiber is only a relative term, since the natural condition is that the fibers on the seeds differ greatly in length. For example, in a variety with 1 1/8 inch staple, each seed will have fibers ranging in length from the short fuzz immediately covering the seed, through the successive lengths called linters and sub-staple, to the commercial staple length, and commonly up to 1 5/8 inches or longer. While this range of fiber length on the individual seed has been known to cotton breeders for a long time, the importance of taking this natural condition of fiber development into account in breeding and selection has not been fully appreciated until recent years.

Since it is not to be expected that complete uniformity of fiber length can be attained in any variety through breeding, one of the problems of the breeder will be to develop a variety with the highest possible percentage of the fibers falling within a narrow range of length. That varieties do differ in the percentages of fibers of different lengths on the seed, and that the fiber of varieties remains more uniform under variable conditions of production, have been indicated.

Much remains to be learned about the relation of spinning quality of to fineness, spirality or natural twist, maturity, and physical structure of the fibers. These and other related characters are being intensively studied by breeders and fiber technologists in the Department of Agriculture and in State Institution, as well as by cotton spinners and manufacturers.

Cluster varieties.—Many so-called "cluster cottons" with very short jointed fruiting branches have been advertised and sold as very productive new varieties. The cluster cotton usually appear very fruitful in the fields because the white cottons shows in large masses where the bolls are crowded together, and sometimes large crops are produced under favourable conditions. In the extreme cluster forms, several bolls may be fused or grown together into what appears to be a single boll with as many as 12 or 14 locks.

A detailed study has shown the cluster habit of growth to be a result of abnormalities in the formation of the branches, which explains the tendency towards sterility. Since this apparently is a general feature of the cluster cottons, it is possible to over-estimate the value of the extremely close jointed type of plant.

None of the cluster cottons has attained more than temporary popularity, to the yields usually are very irregular, and many of the plants may be entirely sterile when the seasonal or other conditions are unfavourable. Other objectionable characters are irregularity in fiber length, excessive shedding under unfavourable conditions, and the difficulty in picking or keeping trash out of the lint where it causes lower grades. In addition, many of the pedicels or flower stems have imperfect joints at the bases, which prevent the buds and bolls that ordinarily would be shed from being detached and falling to the ground. This is very undesirable under weevil conditions, since the natural control of the weevil depends largely on the larvae being killed in the fallen squares by the heat of the sun.

Novelty varieties.—The Department of Agriculture receives many enquiries regarding the possibilities of producing in the United States spepcial types or varieties of cottons as novelties for which high prices would be expected from manufacturers. Two of these varieties that have attracted the most interest in recent years are one producing coloured fiber and a type called "wool" cotton with short wiry fiber.

A variety of cotton with greenish lint, sometimes called "Texas wool", has many times been brought to the attention of the Department by

farmers interested in its possible commercial value. While the greenish lint is the natural colour of the fiber, it does not represent a recognized or desirable variety, but a chance variation that appears occasionally in the fields of white cotton, like red ears in fields of cotton. The fibers are weak and irregular like the short fuzz of the seed, which in some varieties, has a greenish colour. It has been reported that a few bales of this fiber have been raised by farmers who hoped that such a novelty would prove valuable, but could find no market for it.

Many varieties of cotton producing coloured fiber are found in tropical America as well as in Old World, but the fiber is chiefly used for homespuns in the countries in which it grows and is not exported. The range of colour is from light buff to a rather deep rusty brown. Several of of the brownish linted cottons of tropical America resemble the upland cotton grown in the United States, but many belong to the tree-cotton group, which probably could be separated botanically into several species. Samples of cotton cloth made from brown lint have been taken from Indian graves of great antiquity in Peru and other tropical American countries.

In view of the modern development of the art of dyeing, the importance of naturally-coloured fiber is easily over-estimated. The coloured fiber would need to have some other desirable chracteristics to justify its industrial use, whereas most of the coloured variations are distinctly inferior to the white fiber of the same type.

The attention of the Department has many times been called to the variety of cotton with short, coarse, wiry fiber, known as "Gar Hill", or in some localties as "wool" cotton. This cotton came originally from the Garo Hill of North-Eastern India. Small quantities of rough Asiatic cotton similar to the Garo Hill have been imported and used in the United States in the manufacture of blankets, usually at prices somewhat below those of American unplanted cotton.

The possibility of producing such cotton in the United States has received attention at the request of manufacturers, but in most cases it has been difficult to get a stand, yields have been low, and the crop is subject to severe damage in stormy weather. It is also difficult to gin the wool cotton on the regular saw-gins, on account of the small size of the seeds but ways of overcoming this difficulty probably could be found if the crop were satisfactory in other respects.

In plantings made several years ago in Florida, Texas and South Carolina, after a severe rain and windstorm most of the crop had fallen

out upon the ground. This tendency of the fiber to fall out of the bolls if not picked promptly renders this cotton poorly adapted to cultivation in the United States. In China the pickers are kept continuously in the fields and the cotton is gathered soon after the bolls open.

On this basis of the results of many years of experimentation by Federal States, and private investigators, the best advice to American cotton farmers is to leave the novelty cottons alone, and devote their time and energies to the co-operative production of standard, improved varieties that experience has shown offer the best long-time prospects of profitable production.

WORKING OF THE DEPARTMENT OF AGRICULTURE, C. P. 1934-35.

(*Resolution of the Local Government on the working of the Department of Agriculture.*)

The Department of Agriculture continued to show steady progress in all its main activities during the year 1934-35. Government is pleased to note the expansion reported in the opening of seed-farms, sale of improved implements and the practical demonstration carried out by the staff. The value of the increased outturn resulting from the use of improved seeds is estimated at Rs. 55.70 lakhs (54.08). The large attendance of cultivators at the " Farmers' Days " celebrations at Goverment farms and demonstration plots bears testimony to the keen interest taken by them in the activities of the Department.

2. The year recorded further advance in the various branches of research work. The rice research scheme made very satisfactory progress and valuable results are expected from it. The result of cotton research are again most encouraging. The Department has now strains of verum suitable for all conditions of soil and climate to be fund in the cotton-growing tracts of the province. The scheme for the marketing of *verum* cotton had another successful year. The average premium obtained was the highest yet secured, bringing an increased income of Rs. 2.25. lakhs to the participants in the scheme. In *verum* the province has a cotton which, if offered pure, will find a ready market all over the world. Government has, therefore, noted with the greatest apprehension the increasing tendency on the part of merchants to adulterate this valuable cotton. It has been constrained to initiate legislation to combat this suicidal malpractice, but would appeal at the same time once more to all who have the welfare of the cotton-growers at heart to combine to put it down.

3. The outstanding event of the year was the re-establishment of the marketing section on a large scale. It has been long felt that the

conditions in which agricultural products marketed in the province are not ideal, and an improvement is necessary in order to secure for the grower his due share of the final price of his produce. A Deputy Director of Marketing and three Assistant Marketing Officers were appointed. The first work to be undertaken by the new staff will be an intensive survey of existing marketing conditions for the principal crops, so that Goverment may be in a position to remove the handicaps under which the primary producers have been labouring so far. Provincial legislation for establishing regulated markets in the Central Provinces for the sale of agricultural produce other than cotton was also undertaken during the year. Government has read with interest that an orange growers' association has been organised for Nagpur district and that efforts were made by the department to explore a wider market for Nagpur oranges, which were also introduced into France during the year. The experiment is full of promise for the premier fruit industry of the province and Government hopes that further action will be continued in this direction.

4. In the present financial stringency of the province the continuance of the research and demonstration work and the opening of the marketing section would not have been possible without the generous assistance received from the Government of India, the Imperial Council of Agricultural Research and the Indian Central Cotton Committee. Government is pleased to be able to announce that the achievement of more definite results in the research work already undertaken is assured by the extension for a further period of five years of the botanical scheme financed by the Indian Central Cotton Committee. An allotment of Rs. 1·25 lakhs received from the Government of India's grant for rural development will also enable the department to undertake several important schemes which have been held up by financial stringency. These schemes include the opening of a farm for the Mandla district, the purchase of two tractors for the eradication of *kans* grass in the Saugor district, the provision of storage accommodation in markets for the cultivators' produce, the supply of improved bulls to district councils for cattle-breeding, experiments in poultry-farming as a subsidiary industry for agriculturists, and the provision of two more cinema outfits for demonstration work. Government again records its gratitude to the Government of India and these bodies for their assistance.

5. Government congratulates the officers of the department on the year's research and demonstration work. As Director Mr. Ritchie has shown great zeal and initative and has given a new tone to the working

of the department, Government records its acknowledgment of his valuable work.

Gleanings

Measuring the Sunshine in Milk.—Parents and physicians alike rejoiced when it became possible to put vitamin D into milk. Milk is in many ways an ideal food for infants and children but it is sadly deficient in the sunshine vitamin, as vitamin D is often termed. Now scientists have gone a step further and found a way to measure the amount of sunshine vitamin in the milk when it is put there by the action of ultra-violet light. This is important. Baby specialists and nutrition experts have recently painted out that lack of such a measure was one serious drawback to relying on vitamin D enriched milk as the sole source of this vitamin. The method of measuring the sunshine in milk was developed by Dr. H. C. Rentschler of the Westinghouse research laboratories and tested by Dr. G. C. Supplee in the plant of the Borden Company. Strictly speaking, Dr. Rentschler's newly-announced method does not measure the actual amount of the vitamin. Instead it measures, by the photo electric cell, the amount of ultra violet light playing on the milk during every minute of the irradiation process. This is all that it is necessary to measure, Dr. Supplee explained, since scientists have known for years the amount of irradiation needed to impregnate the milk with the required amount of vitamin D. The big thing was to find a way of making sure that this required amount of ultra-violet light was reaching the milk constantly during the process, so that every quart of the irradiated milk delivered to a boy's home would contain the actual amount of vitamin D it was supposed to have. Other ways of putting vitamin D into milk have been found besides the irradiation method, but Dr. Rentschler's new measure is only useful for determining the vitamin. D content of irradiated milk—*Scientific American.*

The Age Factor in Farming.—Perhaps one of the most arresting statements in the Agricultural Research Council's recently-issued report relates to the infiuence of the age factor in farming success. There it is suggested that the oft-held view that farming success depends on an agricultural ancestry and the handing-on of family knowledge from one generation to another is erroneous. Support is given to this contention by the survey of East Anglican Farming undertaken by the Economic Branch of the Cambridge University School of Agriculture in 1932. It appeared from this that, of farmers occupying holdings of over 1,000 acres, an

inverse correlation existed between age and success, measured by farming profits. The lower the age group, the higher the profits. It used to be held that success in farming was largely dependent upon the capacity for sustained hard work. The individual with considerable reserves of energy united with a degree of enthusiasm for his job could break down many of the barriers to farming prosperity by these qualities alone. That there must be a full knowledge of the fundamentals of farming practice goes without saying, but something more is needed in these days, and especially the capacity for looking ahead and the ability to apply the knowledge that results from the researches of scientists and others. Flexibility in farming outlook is a very desirable quality to cultivate an open mind, with the capacity to sift evidence of economic value and to apply it to one's own conditions. It is sometimes possible that enthusiasm for hard work on the part of the farmer is in itself responsible for the limitation of farming profits. This is especially so where there is labour to control and which demands adequate supervision. Farming is becoming more and more of a business, with the need for men who are versed in business methods, and it is from this angle in particular that farming operations and practices must be studied. On this basis tradition and sentiment are largely eliminated, and the key question is one of how to make farming pay. This is a matter that demands time for hard thinking and, one may add, time for discriminating reading.

Intense Sound Makes Milk More Easily Digestible.—Make a loud enough noise at milk and the baby will digest it more easily. That, in effect, is the discovery reported by Dr. Leslie A. Chambers of the University of Pennsylvania. Dr. Chambers spoke before the American Dairy Science Association meeting jointly with the American Association for the Advancement of Science. The apparatus used in the experiments consisted of a heavy steel diaphragm, driven by the oscillating electric current. Similar devices are used for submarine signalling. Over the diaphragm Dr. Chambers flowed a thin stream of milk, while he caused it to vibrate very strongly at various rates. The lowest vibration rate he used was 360 cycles a second, which is the pitch of F-sharp in the middle of the piano keyboard. The highest rate was 3000 cycles a second, about three octaves higher than middle F-sharp. The effect was to alter the curd-forming character of the milk. Whereas the milk used normally formed a hard curd, difficult to digest, when acted upon by the pepsin of the stomach, after treatment it formed a soft, easily digested curd. Soft-curded milk, is especially desirable for feeding babies, as well as oldeo persons with "weak stomachs". Some cows naturally produce soft-

curded milk, but many do not. Dr. Chamber's experiments have demonstrated a simple mechanical method to make soft-curded milk at will, out of any kind milk.—*Scientific American.*

Debt conciliation in C. P.—A press communique issued by the local Government dated Pachmarhi 14th October 1935 says:—"The Central Provinces Debt Conciliation Act was passed in February 1933, and was applied to Berar in April 1934. A start was made by establishing two Debt Conciliation Boards at Khurai and Seoni in July 1933 and 4 more Boards were established at Balaghat, Narsinghpur, Mahkar and Kelapur in 1934. The Board of Khurai completed its work in January 1935 and two Boards for the Saugor and Banda Tahsils under the one Chairman were established in February 1935. New Boards were also established in the Jubbulpore, Betul, Wardha and Akola districts. The Board at Seoni worked for its maximum period of two years and was dissolved on the 15th. In its place a new Board is about to be established in the Bhandara district. Of the five additional Boards to be financed out of the grant received from the Government of India for rural development, four have been established in the Saugor, Nimar, Chhindwara, and Amraoti districts and the location of the fifth Board is under the consideration of Government. For the Sohagpur tahsil a Board has been established at Sohagpur under the chairmanship of the local Sub-Judge in addition to his duties. Government has also established a Board at Yeotmal with a common chairman for this and the Kelapur Board. Upto the end of August 1935, the Boards had conciliated debts amounting to Rs. 1,28,33 lakhs for Rs. 70.65 lakhs, thus effecting a remission of 44% of the claims. Besides this, certificates under Seceion 15 (1) of the Act, declaring that the creditors had unreasonably refused amicable settlement, had been issued in 2108 cases for claims amounting to Rs. 23.94 lakhs. The creditors to whom these debts are owing will not be entitled to costs in suits for their recovery or to any interest after the date of the certificates in excess of simple interest at 6% per annum, on the amount due on the date of the certificates. The instalments are fixed with due regard to the paying capacity of the debtors and no interest is allowed as a rule on the conciliated debts in future. Considering that concilation can be made only by voluntary agreement of both the parties, the progress made so far can be considered satisfactory.

Current Research

Sugarcane in the Punjab, Part 1 P. E. Lander and Ramji Narain (*Ind. J. Agric. Sci.* 5,213).—The Sugar industry of the Punjab must depend for its success very largely on the new imported Coimbatore varieties, the quality of which taken as a whole, has shown a steady improvement during recent years due to the introduction of continually improved varieties. The Sugarcane-survey carried out from 1927 to 1932 in a number of districts of the Punjab has shown that these new varieties Invariably give better yields of cane and sucrose per acre than do the local canes. Based on yields per acre the South Eastern Punjab appears better suited climatically for the production of cane than other localities although the Central Punjab produces a some what better cane. With the introduction of these new varieties, the period of optimum ripeness during which the cane is available for crushing has been considerably extended and now varies from 120 to 135 days according to locality. Since most Coimbatore varieties do not ripen before December, the cultivation of early ripening local varieties such as Katha, Lalri, etc., is still a necessity for early crushing. All varieties are susceptible, in varying degree to the ill effects of frost, and the extent of the damage depends very largely on the condition of the cane at the time frost occurs, healthy canes and those which have received recent irrigation or rainfall will be able to resist frost much better than the same varieties deprived of these mitigating circumstances. Generally speaking the Coimbatore varieties may be arranged as follows in order of decreasing resistance to frost:—

Co. 270, Co. 281, Co. 285, Co. 290, Co. 213, Co. 223, and Co. 205 Canes with succulent leaves and a low fibre content have been found to be particularly susceptible to injury by in sects and disease. The flowering of canes which occurs only in the case of Coimbatore varieties, marks the end of vegetative growth and does not indicate any deterioration in the quality of the cane, and is very likely the result of the particular climatic condition prevalent from September to December. Ratooning is becoming increasingly popular with the introduction of the new Coimbatore canes, as these have proved to be particularly well suited for this practice. The ratoon canes, however, furnish a continuous source of food supply to the various pests common to the crop, and a close watch on a ratoon crop is therefore necessary if the multiplication and spread of such pests is to be avoided. (*Authors abstract*).

Organisms associated with sugarcane mosaic and their relation to the mosaic virus. S. V. Desai (*Ind. J. Agric. Sci.* 5, 367) A method for isolating species of pleomorphic unstable bacteria from sugarcane affected with mosaic has been standardised, and the different cyclostages of these bacteria have been studied morphologically, biochemically and culturally. The bacteria are unique in having a short bacterial cyclostage and an unusually long filterable and invisible cyclostage to the mosaic virus has been established by serological reaction; for this purpose rabits were immunised by inoculating increasing doses of (1) mosaic virus, (2) filterable form of bacteria, (3) bacteria and (4) healthy leaf juice. The agglutination, precipitation and complement fixation reactions brought out the relation of mosaic virus and filterable forms of the bacteria. In vitro neutralisation and inactivation of the mosaic virus was brought about by the anti-healthy juice serum and the anti-bacterial serum failed to inactivate the mosaic virus. Thus a relationship based on neutralization and inactivation of the pathogenic principle was shown to exist between mosaic virus and the filterable forms of the organisms. Biochemical reactions of the organisms were different from all known species of bacteria. (*Author's abstract.*)

The influence of progressive ripening of fodders on the mineral nutrition of cattle. Part I—Mineral composition and the mineral balance as influenced by progressive ripening of fodders. A. Viswanatha Iyer (*Ind. J. Vety. Sci. and Anim. Husb.* 5, 129). The first paper in this series deals with two distinct question:—(a) The mineral composition of some fodders (b) The assimilation of minerals from those fodders. The mineral composition of four fodders, viz. (1) Rhodest grass hay, (2) Aurangabad hay, (3) Spear grass hay and (4) Juar hay at different stages of maturity, has been determined. The mineral content was found to vary from fodder and with the state of maturity. Feeding tests were carried out with these fodders to study the assimilation of minerals. It was found that the state of maturity greatly affected the mineral assimilation, the first cut invariably gives positive mineral balances and the mineral balance becomes less favourable as maturity advances. To obtain positive balances, both Ca and P must be sufficient. For example with Juar P intake is always high, yet, owing to low Ca intake, balance of both Ca and P become negative. The actual minimum intake values found in these experiments are 10 grms. P205 and 15 grms. CaO for an animal of 750 lbs. liveweight. With less Ca and P than these amounts no positive balance is possible under any circumstances. Another point of interest is that while a positive lime balance can be obtained when the lime is above the

phosphoric acid below, the converse, viz., a positive phosphoric acid balance when lime is below the minimum seems unattainable. It must be emphasised that these mineral quantities yield positive balance when conditions are otherwise favourable. (*Author's abstract.*)

The influence of progressive ripening of fodders on the mineral nutrition of cattle, Part II—Urine characteristics as influenced by progressive ripening of fodders. N. Krishna Ayyar (Ind. J. Vety. Sci. and Anim. Husb. 5. 140.) Four typical fodders at different stages of maturity were fed to cattle and the acid base balance of the resulting urine was studied. It has been noted that the early-cut fodders are marked by the elimination of large volumes of urine, definitely attributable to the high amount of alkalis in the food and that with advancing maturity the total fixed bases decrease and the pH of the urine tends to become lower. The bases in the urine of two early-cut fodders were very low and later-cuts of the same fodders showed serious deficiency of bases. One late cut fodder produced definite nutritional acidosis marked by a large increase of urinary ammonia: the acidosis being due not to increased acid production but to the deficiency of fixed bases. Two of the fodders were grown on similar soil yet the one yielded a highly alkaline urine and the other an acid urine. Hence the species of grass and the stage of maturity both profoundly influence the mineral supply to and the acid case balance in the animal. Lime and magnesia show increased deflection into the acidic urine. The execration is not proportional to the intake but depends almost entirely on the pH of the urine. This suggests that the animal experiences difficulty in retaining minerals when the urine becomes acid. This view is supported by the mineral balance data presented in the paper. Urinary loss of calcium being closely related to the pH of the urine, it is possible that calcium assimilation is influenced by urine reaction. It has also been observed that there is an inverse relationship between urinary lime and urinaryphosphoric acid. (*Author's abstract*)

Crop Forecasts

COTTON

Central Provinces and Berar.—Second forecast of the cotton crop for the season 1935-36:

On an average of the five years ending 1933-34, the area under cotton in the Central Provinces and Berar represented about 19.0 per cent of the total area under the crop in British India.

The estimated outturn for the province as a whole works out to 79 per cent of the normal, against 77 per cent estimated at this time last year. Of the important cotton growing districts in the Central Provinces proper, Hoshangabad and Nimar estimate an almoslt normal crop while Nagpur and Wardha districts estimate a slightly lower yield of from 82 per cent to 90 per cent of the normal. The Berar estimates are lower and and range from 67 per cent of the normal in Akola to 82 per cent in Buldana. Conditions are steadily improving and the conservative nature of the Berar estimates may be attributed to the uncertain course of the monsoon this year.

The areas sown during the current and preceeding years are compared in the subjoined table:—

	Estimated area sown during the current year (1935-36)	Estimated area reported in the corresponding forecast of last year (1934-35)	Actual area of last year (1934-35)	Percentage of increase (+) or decrease (—) of column 2 over	
				Column 3.	Column 4.
1	2.	3	4	5	6
	Acres	Acres	Acres		
Central Provinces.	1,347,169	1,363,686	1,286,552	—1	+5
Berar.	2,921,510	2,913,711	2,914,886	..	..
Total.	4,268,679	4,277,397	4,201,438	..	+2

TIL

Central Provinces and Berar:—Second forecast of the til (Sesamum) crop for the season 1935-36:

On an average of the five years ended 1933-34, the area under til in the Central Provinces and Berar represented about 8.4 per cent of the total area under the crop in British India.

Area—In the Central Provinces and Berar together the total area under til is estimated to be 438,571 acres. It falls short of the corresponding area of last year 496, 872 acres) by 12 per cent but exceeds the actual area (337,912 acres) by 30 per cent. The decrease, compared with the estimated area reported at this time last year, is shared by all districts

except Hoshangabad and is chiefly due to the more restricted sowings of this crop. The actual acreage of last year was considerably below normal on account of the unexpected curtailment of rabi sowings.

Outturn—The continuous and heavy early rains affected the Kharif crop adversely but not permanently. The rabi til is in better condition and prospects are, on the whole, hopeful. In Mandla, Betul, Chhindwara, Wardha, Chanda and Balaghat districts the outturn is expected to be between 82.5 and 93.8 per cent of the normal while in the remaining districts of the Central Provinces it is anticipated to be normal or a little above it. In Berar the outturn ranges from 75 to 82.5 per cent. For the province as a whole the outturn works out to a normal crop.

Calender of Operations

By R. N. Sinha.

FLOWERS.

November.—Larkspur seedlings which germinated late, may be ready for transplanting. These may be planted 10 to 15 inches apart according to the height of the variety and nature of the soil.

Candytuft, allysum, mignonette etc. which were sown direct in the beds may be thinned out. The thinning may be done in two instalments.

Chrysenthimums and violets may be given liquid manure as often as possible. The principle in applying this manure should be "weak and often." Any gaps in the flower beds (failures in the seedlings transplanted last month) may be filled in as early as possible.

Regular watering and occasional hoeing are the important points to be observed in flower beds. Water should not be applied over the head of young plants. It should be given to the roots from the sides or in between the plants, before the sun gets hot. Occasionally they may be sprayed overhead in the evening with a watering can having a fine rose.

Well rotten cattle-dung manure may be applied and forked in the canna beds, if possible. This will help them in producing better flowers in December, January, February and March.

Roses will be in growing period. They should have proper attention towards watering and hoeing.

Chrysenthimums will need disbudding if bigger blooms are required.

Operations of budding and putting cuttings may be continued.

December.—Croton cuttings put in during the rains will have developed sufficient roots by this time and may be transplanted singly in small pots.

Like chrysenthemums, roses also need liquid manure and disbudding if bigger blooms are to be expected. Care should be taken in watering. Overwatering generally brings mildew on roses.

Coleus plants will be seen flowering. In order to preserve the vigour of the plants and colour of the leaves the flowers should always be nipped off as soon as they appear.

Roses which were budded in the previous months will need special attention in removiug the side shoots of the stocks.

Budding and putting in cuttings of different varieties of shrubs may be continued.

In order to encourage branching in sweet peas the growing tips may be pinched off once when the plants are 9" to 1 ft. in height.

Roses will be blooming freely to the end of this month. The flowers may be cut freely whenever required for use. "Cut and come back" this is quite true in case of roses. In any case as soon as the flowers are over they should be removed.

January.— Cornations will start flowering. Attention should be paid to disbudding. Liquid manures may be applied to these with advantage.

Sweet peas will be more or less in full bloom. To have plenty and long seasons of flowers see that early seed formation is not allowed. This also applies equally in cases of all flowering plants, but more particularly in sweet peas, cornation pansy etc,

Budding operation can be continued safely. Any failures of budding done in the previous months, may be rebudded now,

Regular watering and hoeing of all the flowering plants should not be neglected.

Chrysenthemums will be getting over. The main plants may be cut out and removed. If necessary cuttings of these main stems may be prepared and planted in pots filled with fine sand or silt.

Sun-flower (small variety), Petunia coreopsis and portulaca seeds may be sown for obtaining flowers during summer season.

VEGETABLES

November.—The cold weather vegetables sown in previous months must be growing vigorously and should have regular watering and hoeing, otherwise the growth will have a check resulting in poor crops.

If possible Beet Roots may be given a small quantity of salt as a manure and also liqnid manure as often as possible.

The following vegetables may be sown now:—

Country Greens.
- Palak
- Ambat-chuka.
- Cholai.
- Methi
- Ghor.
- Onions.
- Brinjals.
- Radish.
- French beans.
- Lettuce.

Cabbages and Cauliflowers may be earthed up and peas may stacked before leaning or falling over the ground. Tomatoes will also need staking.

December.—Brinjals and Onions left out in the last month may be sown now. If the seedlings are ready they may be transplanted. In case of onions it would be worth while applying a small quantity of wood ashes in the ground before planting or after the seedlings have established and started growing.

Country green seeds (recommended in last month) may also be sown in order to get successive crops.

January.—The following vegetables may be sown:—

Brinjal.	Karela.
Onion.	Bottlegourd (Lauki)
Gawar.	Pumpkin
Bhendi.	Dilpasand.
Country greens.	Turai.

Cucumber.

Old kundroo vines may be pruned and if required fresh cuttings may be planted.

Departmental News.

The services of Mr. J. H. Ritchie M. A., I. A. S., Director of Agriculture Central Provinces, are placed at the disposal of the Government of the United Provinces.

* * * *

Mr. J.C. McDougall, I. A. S., Principal, Agricultural College Nagpur, is appointed to officiate as Director of Agriculture, with effect from 12th October 1935, and shall perform the duties of the Principal, Agricultural College, Nagpur, in addition to his own duties.

* * * *

Leave on average pay for eight months, out of India, is granted to Mr. D. N. Mahta, Economic Botanist, Central Provinces, Nagpur, with effect from the 14th November 1935 or any subsequent date on which he avails himself of it.

* * * *

Mr. S. C. Roy Agricultural Assistant on the College and Research staff and First Assistant to the Economic Botanist for Cotton, is appointed to officiate in the Central Provinces Agricultural Service Class I, as Economic Botanist for Cotton.

* * * *

College and Hostel News.

The close of the first term was marked by certain changes in the Department of Agriculture which had their repercussions on the College as well. Mr. Ritchie, our Director of Agriculture, has accepted the Directorship of the United Provinces Department of Agriculture left vacant by Mr. Allan who left us only a few years ago. Mr. Ritchie's departure is a great loss to this province. In 1933 Mr. Ritchie was our Principal for about eight months. Although Mr. Ritchie's connection with the College has been a short one he has left his mark on the College. He showed keen interest in all matters concerning the College and the prospects and status of the Agricultural graduates. As the head of the Department of Agriculture he has established a reputation as a very able and conscientious officer. We wish him all success in his new appointment.

It is a matter of gratification to us that the Government has chosen Mr. J. C. Mc Dougall, our Principal, to succeed Mr. Ritchie as Director. A better choice could not have been made by the Government. Mr. McDougall carries to his post an experience of a wide and varied character, such as has been the lot of few persons to achieve in a short period of service. As Deputy Director, as Assistant Secretary to the Royal Commission on Agriculture in India and as Principal of the College of Agriculture, Mr. McDougall has acquired a thorough insight into the agricultural problems of this country and this would be an invaluable asset to him in directing the activities of the Agriculture Department.

His appointment as the Director of Agriculture is a great loss to the College of which he has been the principal for nearly four years. Though the period is a short one it has been one of exceptional difficulties on account of financial stringency, retrenchment and political excitement. Mr. McDougall has steered clear of all these difficulties with great success. By his love and sympathy and great concern for the welfare of those committed to his care he has endeared himself to one and all. He has visited every sick bed morning and evening whether in the hostel or in the hospital. No Student who went to him for help or advice ever came back disappointed. In his appointment as Director every one of us in the College feels as though we have lost a personal friend, but our sorrow is considerably relieved when we consider the fact that from his new office he would be of still greater service to us.

We also take this opportunity to express our gratitude to Mrs. McDougall who has always taken great interest in our sports and socials. The Tennis Championship Medal that she has been awarding annually has helped considerably to raise the standard of the game in our College. We wish her all happiness.

It is with great sorrow that we record here the tragic motor accident that took place at Morena near Gwalior resulting in the death of our friend Mr. S. A. Rasheed and serious injuries to Mr. Shaukat Ali and Mr. K. R. P. Nair. They were going to Delhi on a holiday trip in Mr. Rasheed's car. While trying to overtake a cart that was ahead of them the car turned turtle and was completely wrecked. At the time of writing Mr. K. R. P. Nair has happily joined us again, though still not quite recovered from injuries and the shock. Mr. Shaukat Ali is still in the Gwalior hospital. We pray for his early recovery.

Mr. Rasheed was very popular amongst all students and was a thorough gentlemen in every respect. He was a very good sportsman and

was our strength in Tennis and Football. His tragic death is deeply mourned by one and all.

On the re-opening of the College after the Diwali holidays the students and staff of the College met and passed the following resolutions:—

(1) The staff and the students of the College of Agriculture Nagpur deeply regret the sad death of their dear friend Mr. S. A. Rasheed in a motor accident near Gwalior on the 26th of October. They offer their heart felt sympathies to the parents and near relations of the deceased and pray God that his soul may rest in peace.

(2) The staff and the students of the College of Agriculture Nagpur deeply regret the injuries sustained by their dear friend Mr. Shaukat Ali in a motor accident near Gwalior on the 26th of October. They offer their sympathies to the parents of the injured and pray God that Mr. Shaukat Ali may soon recover from his injuries.

(3) The staff and the students of the College of Agriculture Nagpur have learnt with deep appreciation, of the timely and valuable services rendered to the students of their College, Messrs. S. A. Rasheed, Shaukat Ali and K. R. P. Nair, when they met with a motor accident on the 26th October near Gwalior, by Colonel Sardar Bahadur Girdhari Singh, Lieut. Yadunath Singh, the hospital authorities at Morena, and the Jaya Arogya Hospital, Gwalior, and the Inspector General of Police, Gwalior. They are highly thankful to them for their act of kindness.

OBITUARY

We have to intimate with deep sorrow the death of one of our friends Mr. S. A. Rasheed of the Senior B. Ag. class as the result of a motor accident near Gwalior on the 26th of October 1935. The following resolution was passed in a meeting of the Students and Staff of the College.:—

(1) The staff and the students of the College of Agriculture Nagpur deeply regret the sad death of their dear friend Mr. S. A. Rasheed in a motor accident near Gwalior on the 26th of October. They offer their heart felt sympathies to the parents and near relations of the deceased and pray God that his soul may rest in peace.

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Contents.

Mr. E. A. H. CHURCHILL.

OUR NEW PRINCIPAL

We extend a hearty welcome to Mr. E. A. H. Churchill in his new capacity as the Principal of the College of Agriculture, Nagpur.

Born in Somerset, Mr. Churchill received his early education in Clifton College, and graduated from the Edinburgh University in 1914—the year of the commencement of the Great War. For about six and a half years he served the Army, in India, Afghanistan, Aden and Mesopotamia. His first association with Nagpur dates back to the year 1914, when he was with the army stationed in the Sitabuldi fort and was one day shown round the College Farm by Mr. Allan. After the conclusion of the war Mr. Churchill joined the South Eastern Agricultural College, Wye, for some time. He joined the Indian Agricultural Service in 1922, and subsequently served as Assistant Director and Deputy Director of Agriculture in the Northern Districts of our Province. His prolonged and direct contact, extending for more than 12 years with the conditions in the rural areas has given him a thorough insight into agricultural matters which must have been of immense value to him in successfully tackling problems which sprang from the attack of rust and frost on the *rabi* crops of the Northern Circle in the years 1928 and 1929. His efforts during the "scarcity period" have been the subject of much deserved appreciation.

Mr. Churchill is no stranger to this college. He officiated once before, as Principal in 1930. He returns to us with a wider experience of the agricultural conditions of our province, and a more thorough acquaintance with every kind of farm machinary. Mr. Churchill has a reputation as a strict disciplinarian. He is equally known for his kind heart and generous disposition. We are confident that he will make a worthy pilot for the college, and that the sound traditions truly laid by his notable predecessors, will be more firmly secured than ever under his fostering care.

We wish Mr. Churchill the best of luck, and all success in the discharge of his new responsibilities.

Mr. R. G. ALLAN

We offer our felicitations to Mr. R. G. Allan on the honour of C. I. E. conferred on him as a recognition of his services in the cause of Indian Agriculture. Mr. Allan joined the Indian Agricultural Service in 1907 and came to the Central Provinces as the Principal of the Nagpur Agricultural College which position he continued to hold till March 1932 when he was appointed as the Director of the United Provinces Department of Agriculture. His tenure of office as Principal of this College is a note worthy one not only for its length of years but also for the opportunities he had for shaping agricultural education in this province. The reputation which the Nagpur agricultural college enjoys at present as one of the best institutions of its kind in India is, to a large measure due to Mr. Allan who guided its destiny for over 25 years. Mr. Allan has just retired from the Indian Agricultural Service, but has chosen to serve the cause of Indian Agriculture for a further period of years as Agricultural Advisor to the Government of Baroda. The staff of the Central Provinces Department of Agriculture and the students of the College unite in congratulating Mr. Allan on the well-merited distinction conferred on him and in wishing him every success in his new appointment.

The Nagpur Agricultural College Magazine

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Editorial

AGRICULTURAL INDEBTEDNESS

Early in 1935, when Diwan Bahadur T. A. Ramalingam Chettiar introduced a Debt Conciliation Bill into the Madras Legislative Council, the Government of Madras appointed a Special Officer to enquire into the extent of indebtedness amongst the agriculturists of the presidency with a view to finding out the advisability or otherwise of introducing such a legislation. The terms of reference also included other points such as the effect of the depression on the agriculturists, the extent to which land has changed hands in the last four years and the facilities now afforded by the Land Mortgage Banks and Co-operative Societies. The report of the Special Officer which was recently published is a very interesting document covering the whole field of agricultural finance. The report shows that indebtedness is wide spread amongst all classes of the rural population and that more than three-fourths of the registered holders and tenants of the province are in debts. The total agricultural debt of the presidency is calculated at about Rs. 200 crores. The debt per head of popula-

tion is 38 per family 194, per acre of occupied land 63 and per rupee of assessment 21. The estimates of the Special Officer, of both average indebtedness and total indebtedness, show an increase over similar estimates of the Banking Enquiry Committee which reported in 1930. This is a clear indication of the miserable plight into which the cultivating classes have been thrown by the economic blizzard.

The report points out the extent to which land has changed hands since the beginning of the depression. It is estimated that over 10,000,000 acres have changed hands between 1931 and 1934 and that a fifth of these went to non agriculturists with the result that a large number of small and medium proprietors have been rendered landless and destitute. A large proportion of the land has been acquired by absentee landlords particularly agriculturist money leaders.

Various causes have contributed to this unfortunate state of affairs. Agriculture in India, with the exception perhaps of the raising of a few commercial crops, is not a profit making concern. The net agricultural income of the province is estimated at 40 crores of Rs. for 1933-34 to support a population of 34 millions giving an average income of Rs. 11-12-0 per head of rural population. Again normal years are not very common in India. The monsoon may fail or it may come in torrents sweeping every thing harvest hamlet and herd before it. In such circumstances to support a family upon a small and fragmented holding requires a level of skill industry and thrift not generally found in this country. There are several other factors such as the high interest rates charged by the money-lenders, the interception of profits by hordes of middlemen, expenses on ceremonies and festivals, cattle mortality etc, which prevent the cultivators from accumulating the capital required for their own use and consequently keep them perpetually within the grips of the creditors. The burden of debt has now become so heavy that unless substantial relief is given the ruin of the peasantry is certain.

The Special Officer is definitely in favour of debt conciliation by legislation. He recommends that the minimum and maximum figure of the debts should be kept sufficiently low so as to give relief to all except the bigger landlords and zamindars. He also suggests the grant of *Taccavi* loan to help the debtors to clear away amounts settled below 500 Rs. while higher amonts may be lent by the co-operative institutions. He also recommends that those whose earning capacity is too small to repay debts even in instalments and who have no tangible security to offer should be declared insolvents even though their debts are below 500 Rs.

Debt conciliation is a purely temporary expedient intended to relieve the cultivators from the embarrasing situation precipitated by the economic depression. To give lasting relief and to prevent the vast body of cultivators from relapsing into debt it is necessary to increase their earning capacity by making agriculture a more secure and paying concern.

Original Articles

DETERMINATION OF CARBON AND NITROGEN BY OXIDATIVE DIGESTION.

BY V. SUBRAHMANYAN, D. SC., F. I. C.

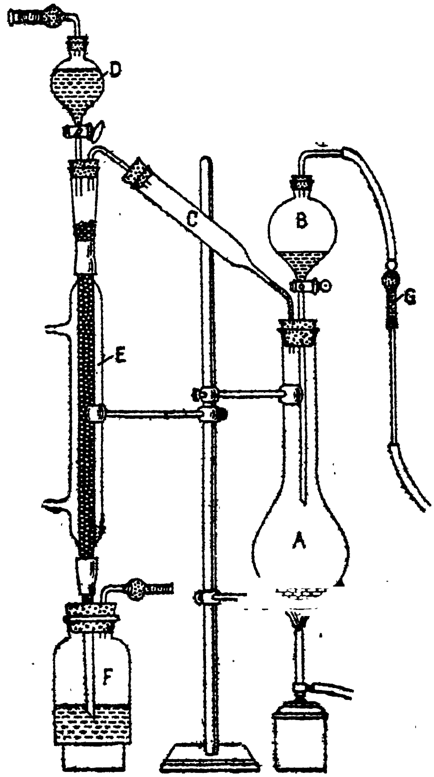
Department of Biochemistry,
Indian Institute of Science, Bangalore.

During the past few years, a large number of methods have been proposed for the estimation of these two important constituents. Among these, a few are intended for both the determinations being carried out on the same sample. Such methods yield fairly reliable estimates of carbon but are generally unsatisfactory when applied to nitrogen. Owing largely to this defect, the two determinations are usually carried out by seperate methods.

It has been recently shown [1,2] that when an aqueous solution or suspension of an organic substance containing nitrogen is heated with a mixture of sulphuric and chromic acids, the digestion proceeds very rapidly (in under 30 mins.) without evolution of fumes, the vapours which pass over consisting of air, carbon-dioxide water and traces of nitric acid. Water and nitric acid can be easily condensed, and the carbon dioxide absorbed in excess of alkali. The residue in the digestion flask contains the major part of the nitrogen, but a small part remains in combination with the chromium. A further quantity is converted into nitric acid. In addition to this, a small portion will be lost as elementary nitrogen if the oxidising agent is added in the cold. This loss, which is traceable to the intermediary formation of ammonium dichromate can be entirely avoided by changing the order of addition of reagents. If the material to be digested is just raised to boil with a mixture of sulphuric acid (2 parts by volume) and water (1 part) and then treated with chromic acid, there is no intermediary formation of ammonium dichromate so that the loss of nitrogen is thus eliminated.

It may be mentioned, in this connection, that the loss of nitrogen observed by Acharya[3] at low temperatures and under conditions of reduced pressure, does not occur—at any rate in the case of soils and commoner biological materials—at high temperatures and at atmospheric pressure. There is some loss of nitrogen if the substance contains a halide but this can be eliminated by adding a mercury salt, preferably the oxide.

Based on the foregoing and other observations, an accurate and rapid method for the estimation of carbon and nitrogen in the same sample of soil or other biological material, has been developed. The procedure as worked out by Messrs Bhaskaran, Harihara Iyer and Rajagopalan in these laboratories may be outlined as follows:—The substance (soil 10g; others in proportion) is weighed into A, which is a Kjeldahl or other type of long-necked round-bottomed flask of capacity about 500 c. c. It is then treated with mercuric oxide (red or yellow, 2g.) and water (15 c. c.) and fitted in position as shown in the figure.



Through tap funnel B (capacity, about 100 c. c.) concentrated sulphuric acid (40 c. c.) is introduced into A. (It should not be ordinarily difficult to introduce the acid. If the material is rich in carbonates or there is otherwise heavy pressure of gas inside, then the acid can be blown in, the rubber tube extension with soda-lime guard G being used for the purpose). The last portions of the acid are rinsed down with 1-2 c. c. of water. (This is to facilitate the subsequent introduction of

chromic acid which would otherwise be precipitated as the anhydride and choke up the tube). The contents of A are just raised to boil. The flame is then momentarily removed and a saturated aqueous solution (5 c. c.) of chromic acid (CrO_3) introduced through B.

The heating is then resumed, the flame being so adjusted that the water vapour condenses in the wide tube C. (length of the wider part, 6-8"; internal diameter, about 1") Only carbon dioxide and air pass into E which is an ordinary straight condenser packed with glass beads. Standard alkali (2 N; 25-50c. c.) is kept dropping from D. The cooling combined with the large surface exposed by the glass beads facilitate rapid absorption of carbon dioxide by the alkali which ultimately drops into reservoir F.

The reaction with chromic acid is almost instantaneous, so that within 15 minutes, the entire quantity of the substance is oxidised. The heating may be continued for a further period of about 10 minutes so as to ensure complete displacement of the carbon dioxide from A and C. The flame is then removed and tap D opened to equalise pressure. The alkali adhering to the funnel and to the glass beads is washed down to remove water, drops of phenolphthalein being added from time to time to ensure complete removal of the last traces. The contents of F are then taken out and treated with excess of barium chloride (20. c. c.; 10 per cent.) and the unused alkali titrated against standard acid (2 N). The end point will be sharpened by either finishing the titration against weaker acid (N/10) or, after the phenolphthalein colour is discharged, back—titrating against standard alkali (N/10) until the colour is just regained.

The digestion flask A is disconnected after rinsing down the chromic acid adhering to B. The contents are then transferred to a distillation flask (capacity 1500 c. c.) with frequent washing (200-300 c. c. of water), treated with pure sodium sulphite to reduce the unused chromic acid and raised to boil. (5-7 g. of sulphite is usually sufficient for the purpose. The sulphite need not be weighed, but may be added in small quantities at a time until the smell of sulphur dioxide is just pronounced. The end point is also indicated by the change of colour from emarald green to pale blue.) After boiling for about 5 minutes, pure zinc (2g.) added and the boiling continued for a further period of 10 minutes. The mixture is then cooled, treated with excess of alkali and distilled in the usual way.

Estimation of carbonates.—The above apparatus can be utilized for the estimation of carbonates. The determination may be carried out either

independently or in conjunction with the estimation of organic carbon. In the former case, the carbonate may be decomposed with dilute hydrochloric acid and in the latter, with excess of phosphoric acid. The residue after hydrochloric acid treatment is not suitable for the estimation of organic carbon because of the presence of excess of chloride. Sulphuric acid is not suitable for the purpose because in the presence of alkaline earth carbonates (which are present in many soils), the insoluble sulphate forms protective coats around the particles of unattacked carbonate and thus prevents them from reaction with acid. Even fairly concentrated acid (2:1), combined with prolonged boiling, cannot decompose all the carbonate so that low values are generally obtained. Phosphoric acid forms the insoluble alkaline earth phosphate, but on addition of increasing quantities of acid, the precipitate dissolves out forming the soluble acid salt and thus exposing all the carbonate to the action of the acid. The residue after treatment with phosphoric acid can be used for the estimation of organic carbon.

Total carbon to include carbonates.—In routine practice, a convenient procedure will be to first test the substance to determine whether it contained more than traces of carbonate. If there is marked effervescence on treatment with dilute hydrochloric acid, the material may be treated with excess of phosphoric acid so as to decompose all the carbonate. Sulphuric and chromic acids may then be added and the digestion continued in the manner already described. If, on the other hand, there is no effervescence or only a faint evolution of gas, then pre-treatment with phosphoric acid may be avoided and the contents of the flask digested straight away with sulphuric and chromic acids.

The procedure for the estimation of carbonate by the phosphoric acid method may be outlined as follows:—To the original contents of the flask (material + mercuric oxide + water) syrupy phosphoric acid (sp. gr. 1·8; 10 c. c.) is introduced through B. (if the percentage of carbonate is very high, the acid will have to be blown in, the procedure being the same as already described). The contents are raised to boil. The water vapour is condensed in C and carbon dioxide absorbed in E. After about 15 minutes, the heating is stopped and the unused alkali washed down into F and back titrated. The residue in the flask A can then be utilized for the estimation of organic carbon; in this manner, carbonate and organic carbon can be determined in the same sample.

As already explained, decomposition of carbonate by hydrochloric acid (1: 15) can be adopted only when the residue is not to be used for the estimation of organic carbon. Otherwise phosphoric acid should be used,

The foregoing methods have been successfully applied in the study of biochemical problems relating to soils. It has also been extended to investigations on the physiology of micro-organisms. The technique has been applied to the estimation of carbon and nitrogen in organic substances. In most cases, no special treatment is needed, but in a few, previous reduction in acid or alkaline medium is needed to eliminate the possible loss of nitrogen consequent on treatment with chromic acid. Attempts are also being made to develop a micro-modification specially adapted for the study of biological products.

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A PRELIMINARY NOTE ON THE ROOT STUDY OF LINSEEDS

By Ravi Shanker, L. Ag.

Assistant to the Second Economic Botanist, C. P.

Part I

Roots constitute a very important part of the plants; and it is rather surprising, that so little attention has been paid to their study until recent years, and this is probably largely due to the fact, that the roots are under ground hidden from our view. It is, however, now being increasingly acknowledged that a complete knowledge of the habits and requirements of the plants cannot be obtained without an adequate study of its root system which is the organ which performs the important roll of absorption of mineral nutrients which constitutes the plant food.

For a plant-breeder, concerned with the improvement of crops, a complete knowledge of root system is of utmost importance in recommending varieties suitable for different environments. For instance A 088 wheat a selected variety, is recommended for the 'bunded' tract in the north of the province but when grown in the open tract of Hoshangabad, it gives a poor yield owing to the fact that its root system is shallow, sparse, and therefore not suitable for the open comparatively dry tract of Hoshangabad, for which other strains like A013 and A085, which possess deep penetrating roots, are recommended.

In this paper it is proposed to give a brief account of the results obtained in the study of the root-systems of linseed which is the most important oilseed crop of the province.

For the purpose of the root study all the local varieties of linseed were grown on the College farm. After the usual cultivation, the seed was drilled 8" apart from row to row. In order to obtain an accurate idea of the development of the root-systems, the roots were exposed at three different stages during the growing season; first washing was done in the month of December i. e. before the plants were in flowers; second when the crop was in full bloom; and the third when the crop was almost ready for harvest. The exposure of the entire root system is, by no means, an easy task, but after some experience a suitable method was devised and it proved quite effective. A trench about 3' by 3' was dug about a foot away from the plants under study, depth of the trench nearly corresponded with the depth to which the roots penetrated. The earth was gradually washed away by means of a jet of water produced from a spraying machine. In order to maintain the normal position of

the roots, small pegs were inserted in the soil horizontally from time to time.

An examination of the root-systems of the different types of linseed showed that the crop possesses tap root which penetrates vertically downward, the actual depth varying in the different varieties. The difference is not so marked in the earlier stages but becomes distinct as the plants attain maturity. On an average it may be stated, that the difference in depth between the shallow and the deep roots may amount to as much as 15 " to 20 ". Considerable difference was also observed in the mode of branching. The root systems may be described as being either mesophytic or xerophytic. In the former case the root branches are produced at more or less right angles to the tap root and run almost horizontally outwards into the soil their length varying 2 " to 12 " and they carry also secondary root branches. In the second case the laterals are produced 5 " to 8 " below the soil surface, They first run obliquely and then turn downwards vertically to a depth which is sometimes as great as the tap root. The xerophytic roots are thicker than the mesophytic and the former produce a large number of short, thin secondary and tertiary root branches.

According to the nature of the laterals and the depth of root systems the latter may be classified into four types as shown below:—

I Xerophytic

(*a*) tap root deep ... Type 1
(*b*) tap root shallow ... Type 2

II Mesophytic

(*a*) tap root deep ... Type 3
(*b*) tap root shallow ... Type 4

All the root-systems of linseeds met with in the province can be included in one or the other of the four types mentioned above.

Description of the Root-Systems. Type 1.—This root-system is characterized by the presence of both the xerophytic and mesophytic root branches and deeper penetration of roots. The tap-root penetrates to a depth of 45 " to 55 " and the root branches arise about 4 " below the soil surface. First a few mesophytic root-branches are produced which run more or less horizontally and these are generally short. xerophytic root branches are produced 6 " to 10 "

below the soil surface and upto a depth of 12" to 18". The tap-root is fairly thick in the beginning but it is reduced to about 2 mm. thickness where xerophytic roots are produced. This thickness is constant upto the root tip. Below the depth of about 20" the root branches are few, thin, delicate, short, and far apart from one another, their length varying from half to three inches. The feeding zone, i. e. the area where numerous and active root branches are produced, is fairly deep in this case. The lateral extention of roots is 20" to 28." (fig. 1). Linseed No. 43 and 55 and a few other linseeds of the southern districts are characterised by this kind of root system.

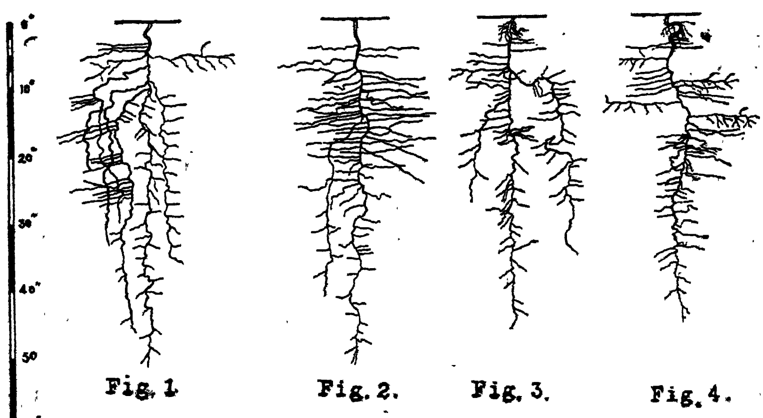

Fig. 1   Fig. 2.   Fig. 3.   Fig. 4.

Root-systems of Linseed.

Type 2.—It differs from type 1 in depth of penetration and the number of root branches. The tap-root penetrates only 30" to 35" deep and 1—3 xerophytic root branches are produced in each plant. The feeding zone is 10" to 12" deep and the lateral extention is 14" to 20", (fig. 3). Linseeds of Chattisgarh and a few European flaxes have root system of this type.

Type 3.—This root-system is characterised by absence of xerophytic root branches. The tap-root penetrates 45" to 55" and is fairly thick at the beginning but below a depth of 5" to 6" it is only 2 m. m. This thickness is constant upto the tip of the tap-root. It produces numbers of mesophytic root branches. These are produced below a depth of 4" to 5" and the tap-root branches freely upto a depth of about 25." Below this depth the root branches are few and much further apart, their

length varying from half to three inches. The feeding zone is 20" to 24" deep. (fig. 2). Linseed E. B. 3 and a few other linseeds of the northern districts have this type of root system.

Type 4.—This root-system is less extensive than type 3, other wise it is similar to the latter. Depth of penetration varies 30" to 40" and the lateral extention is only 14" to 20". (fig. 4) The linseed varieties introduced in this province from the alluvial tracts possess this type of root system.

Linseed is a rabi crop in this province and its success is, thus, dependent on the amount of water stored in the soil during the monsoon months. In Berar and the southern districts of the province where the average rainfall varies from 15" to 35" and the winter months are usually dry the upper layers of the soil get depleted of the moisture early in the season. Under such conditions a crop of linseed will have to depend for its requirements of water supply on the lower regions of the soil and a variety possessing the root system of type described above which produces a number of freely branched and deep penetrating roots, would appear to be the most suitable type to grow. The fact is borne out by the figures of the varietal test conducted on the College farm, Nagpur, over a number of years which show that linseed No. 55 and 43 which have root-systems of type 1, have given the best results.

The conditions in the north of the province are different. Here the average rain fall amounts to 55" to 65" the rain water is allowed to stand in the fields throughout the rainy season and is not let out until a fortnight before sowing. Winter season being comparatively cool and long, the soil does not dry with anything like the rapidity of the southern districts. Under these conditions a shallow rooted variety would appear to be well suited; but owing to the appearance of cracks in the soil later in the season, shallow rooted varieties are apt to be damaged and therefore the varieties possessing the root-system of type 3 which produces numerous root-branches in the upper layers of the soil and is sufficiently deep-seated, has been found to do well. E B. 3 linseed which possesses root system of type 3 has given the best results in the experiments conducted in the agricultural stations of the northern districts. The plants having the root-system of type 4 have not been found to thrive under the conditions obtaining in this province. One of the reasons of the failure of the Pusa Linseeds as well as those of the Gangetic plane is that their root-system is not suitable for the condition available here.

Part II

Effects of certain manures on root development.—The three chief ingredients required for successful development of agricultural crops in general are nitrogen, phosphorous and potash. The last is generally present in sufficient quantities in the Indian soils and the practice, therefore, is to replenish nitrogen and phosphorous removed by the previous crop. While considerable amount of information regarding effects of nitrogenous and phosphatic manures on the development of the crop plants is available, very little attention has been paid regarding their effects on the development of the root system. This study was therefore under-taken with the above object in view, linseed E B. 3 being the type used. Seed was drilled in long strips in an uniform piece of land on black cotton soil of the college farm, Nagpur. Equal doses of ammonium sulphate, ammonium sulphate and super phosphate in combination, and super phosphate alone were applied. The method of study of the root-system as well as the stages at which the roots were exposed were the same as described above. These experiments were started in 1932 and were repeated in 1933 and 1934 to verify the results of the previous years.

It was observed that where ammonium sulphate was applied, the tap-root was found to have penetrated to an average depth of 43". Numerous laterals, long and profusedly branched were seen below a depth of about 4" to 6", but below the depth of about 10" the laterals were short and less branched and much further apart. On the whole the root system under this treatment was rather shallow but the lateral extension was more.

With the treatment No. 2, the tap-root was found to have penetrated to an everage depth of 50" and followed a curiously zigzag course. The root branches were shallow, but were more in number and shorter in length than they were in the treatment No. 1.

Super-phosphate on the other hand produced a deeper tap-root penetrating to an average depth of 63". Root branches were short, deeply penetrating and much more in number. On the whole the root system in this case was the deepest and the root branches were short and largest in number.

It would thus appear that the application of nitrogenous manures results in abundant, and well branched root system, but fail to penetrate deeper layers of soils. The study therefore shows that full effects of the nitrogenous manures cannot be realised by a crop growing in tracts

where the upper layers of the soil are lacking in moisture. It may be one of the reasons why the nitrogenous manures are not effective for rabi crops under dry cultivation.

The application of the phosphatic manures results in deeper penetration of the roots. The roots of plants which received a dressing of phosphatic manures were found in the first washing, when the crop was about a month old, on an average 8" deeper than those of the unmanured plants and the difference in the depth of penetration of the roots of the two was maintained throughout the growing season. The crop manured with phosphatic manure also ripened a week earlier, possibly, as a result of earlier development of roots. Use of the phosphatic manures may therefore be recommended where deeper root development is considered advantageous. The value of phosphatic manure is proved from the manurial experiments with cotton conducted on the 'bhata' soil at Chandkhuri farm. 'Bhata' soils are very light and the water table sinks down very rapidly, application of the phosphatic manures enabled the roots of cotton plants to keep pace with the decending moisture and thus a successful crop of cotton could be raised. The study also shows that under dry cultivation, application of the mixture of both nitrogenous and phosphatic manures will be the most advantageous as the inverse effects of the one are nutrilized by those of the other.

THE UTILISATION OF MOLASSES

By A. B. Mitra,

(*Junior B. Ag.*)

With the development of the sugar industry in India the supply of molasses has increased many times its demand; so much so that it has become a problem for the mills to find suitable ways to dispose it of.

The following table * will show clearly the vast quantity of molasses produced every year by the factories in India.

	1933-34	1932-33
	Tons.	Tons.
Old Factories.	127,913	81,692
New factories.	62,471	48,727
Total.	190,384	130,419

Sir B. C. Burt of the Imperial Council of Agricultural Research has shown in his article 'The Indian Sugar Industry' that except in favoured instances, molasses no longer fetch any thing beyond a nominal value.

* Agriculture and Live-stock in India-Vol. V Part. 1

The reason for this is that, the ultra-rapid multiplication of modern sugar factories had resulted in a sudden increase in molasses production so as to disorganise the trade in that product. But the days are not very far when people in general will understand the real utility of molasses, that it can be utilised by the same soil which yielded it.

What a great increase in the yields of the crops can be brought about by the use of molasses as manure is evident from some of the recent experiments carried out by Prof. Dhar and his colleagues which show that rice land is highly benefitted by the application of molasses, molassed land producing 14.5 maunds per acre as against 8.1 in the unmolassed field. The straw is also greater in quantity in the molassed than in the unmolassed field. Similar is the case with sugar-cane where Messrs. Parry and Company of Madras and the Shahjehanpur farm have obtained an increased yield of 40 per cent with molasses as manure.

Some more results obtained by Prof. Dhar and his colleagues show that nitrogen is always greater in the plots when the aritificial fertilizer ammonium sulphate is applied together with molasses than those having a dressing of ammonium sulphate alone. Hence a mixture of molasses and ammonium sulphate is a better fertilizer than ammonium sulphate alone.

So it is evident from the above facts that nitrogen is added to the soil when molasses is used as manure, but we should know how it gives rise to nitrogen in the soil. The sugars present in the molasses combine with the oxygen of the air with the help of bacteria, sunlight and substances like iron, manganese etc. which are always present in the soil. In the course of oxidation and combination of sugars with oxygen large amounts of energy are set free and this energy is utilised for the combination of the nitrogen and oxygen of the air forming nitrates and ammonia which are excellent plant food materials. It not only adds nitrogen to the soil but also increases its humous content and the beneficial effect lasts for two years.

The way in which molasses is applied to the soil is different from that of artificial fertilizers. It must not be given to the growing crop but should be applied to the fields two to three months before the sowing of the crop. After it has been added the soil must receive at least three to four ploughings before sowing, watering is done as in case of ordinary cultivation. It has also been found out that the moisture content of the molassed field is greater than that of unmolassed.

In addition to the use of molasses as nitrogenous manure it can be put to many more uses. It is well known that there is a demand for molasses for use in the curing of tobacco and in the past when the sugar industry was not developed in India large quantities of it were imported from Java for the same purpose. Other products such as alcohol, mythilated spirit, yeast, potash, carbondioxide etc. can also be obtained from it. In fact the manufacture of alcohol and its admixture with petrol for motor fuel was recommended by a subcommittee appointed by the Imperial Council of Agricultural Research as a method for the utilisation of molasses.

Mr. M. P. Gandhi, the energetic and learned secretary to the Indian Sugar Mills Association also deals with the question of by-products in one of his pamphlets. The three chief possible outlets for molasses are according to Mr. Gandhi production of methylated spirit, extraction of potash, a rich fertilizer and preparation of alcohol for power in partial substitution of petrol. The minor outlets for the disposal of molasses are the production of yeast, utilisation as cattle food road surfaces, cheap confectionary for the consumption of the poor in the rural areas, and fuel.

Recent researches have shown that molasses can very well be utilised for the reclamation of alkali soils. It is well known that molasses contain between 69 to 70 per cent of carbohydrates (sugars) 4.5 per cent potash, 2 per cent lime 0.5 per cent phosphoric acid 0.5 per cent iron and aluminium oxides and 0.5 per cent combined nitrogen and the rest water. Moreover, molasses is distinctly acidic.

Research work carried out in some of the places in India like Allahabad, Bangalore and in other sugar producing countries like Java and Hawaii shows that when molasses is added to the soil, along with carbonic acid, organic acids are produced in the early stage of the decomposition and partial oxidation of the molasses takes place. The acids thus produced together with the acids present in molasses can neutralise the alkali of the alkali soils. Dr. Dhar and his colleagues have also shown by experiment that molasses is a better reclaiming agent for alkaline land than either gypsum or powdered sulphur because there is loss of nitrogen from soils by the application of these latter re-claiming agents where as nitrogen is added to the soil by the application of molasses.

There are examples of successful reclamation of alkaline lands by the use of molasses in different parts of the United Provinces and Mysore where crops are being grown in areas where no vegetation was ever expected.

Extracts

RECENT PROGRESS IN FRUIT-GROWING IN INDIA AND ABROAD.*

By G. S. Cheema, D. Sc., I. A. S.,

Horticulturist to Government of Bombay, Poona.

The Importance of fruit-growing.—Fruit-growing is an important source of wealth in several countries in the world. It is regarded as a money crop irrespective of whether the fruit is sold fresh or is converted into other valuable products. It provides both work and cash even under adverse economic circumstances and thus enables the farmer to meet liabilities which would otherwise weigh heavily on his holding. It is not surprising, therefore, that a tendency to encourage fruit cultivation has been apparent in all countries during the past decade. The mention of the monopolies in the fruit trade will give some idea of the importance and magnitude of fruit-growing in other countries. Italy, for example, specialises in the cultivation of citrus fruits and wine grapes and the world trade in Italian lemons is her monopoly. Her annual export of citrus fruits comes to about 301,000 tons. The French growers enjoy the privilege of specialising in the cultivation of certain wine grapes, and French viticulture is a great asset to the nation, and undoubtedly reflects credit on the ability of the growers who have held their position for ages. The total annual wine production of France amounts to 1,232 to 1,254 million Imperial gallons, out of which 15 million gallons are exported annually. Algeria is an important source of the French supply of wines. Turkish fruit-growers, helped by their own natural resources and foreign exploitation, more than by scientific organisation, have a strong hold on the world market for their dried figs and sultanas, the export of which amounts to more than 75,000 tons annually. Though their fruit industry is of comparatively recent growth, the United States of America with their scientific ability, perseverance and organisation play a leading role in this field. Their annual exports amount to 238 million pounds of canned products, 13 million boxes of fresh fruit, and 365 million pounds of dried fruit. Spanish fruit growers also occupy a prominent place in the fruit trade, as Spain exports oranges and grapes annually to the extent of 931,100 tons. The anuual export of Spanish oranges to the United Kingdom alone is 300,100 tons.

In Many British possessions and Dominions such as West Indies, Palestine, South Africa, New Zealand, Canada and Australia, fruit-growing

* Agriculture and Live stock in India, Vol. V Pt. V, Septr. 1935 Page 473.

is being developed on scientific lines. Fair quantities of bananas, oranges and apples are shipped to the United Kingdom, from British territories. The annual import of fruit into United Kingdom, however, amounts to £ 48,000,000 worth, inclusive of foreign imports, which come to 70 per cent. Countries like Iraq, Afghanistan, Persia, part of Russia and Japan also claim fruit-growing as a principal source of income to the agriculturist and are endeavouring to develop their fruit export.

In India the development of the fruit industry forms but a minor part of our agricultural activities for, despite a vast range of soil and climatic conditions, fruit cultivation is not commercialised. Although India has some five million acres under fruit, she imported in 1933-34 fifteen lakhs worth of fresh fruit, 19 lakhs worth of almonds, currants and raisins, 36 lakhs worth of dates and 10 lakhs worth of canned and bottled fruit. Also other dried fruits and vegetables, for which classified details are not published, valued at 14 lakhs. Exports of fresh fruit only amounted to 4 lakhs worth. Exports of dried fruits and vegetables totalled 69½ lakhs, but fruit forms only a part of the total. The natural facilities and forces of India, suitable for this development are not properly harnassed, although there is a growing demand for fresh fruits and vegetables among her people, which can be noted by the steady increase in the imports of fruit. The total area of about five million acres under fruit and similar crops in India has remained practically steady for several years past and the expansion in acreage has not kept pace with the increased demand, which is now supplied by imports from abroad to an appreciable extent.

Research in Fruit-Growing.—A study of the development of fruit industry in various countries brings out the fact that research relating to fruit-growing deals with the following aspects of this industry.

1. The breeding of suitable varieties to meet the commercial needs of the world.

2. The selection of proper root stocks, and the adoption of convenient methods of propagation to facilitate their distribution on a large scale.

3. Nutrition of fruit trees, pruning and cultural operations to get higher yield per unit area.

4. The improvement of transport and storage to reduce damage during movement and the sale period of fruit.

5. Methods of preservation by which surplus produce can be economically converted into more valuable products.

6. Pests and diseases which attack fruit trees and reduce their yield and economic values.

Where fruit-growing is an organised industry, every aspect of fruit cultivation is studied scientifically.

Fruit trade Control.—In addition to the investigation of the above aspects of fruit-growing, trade control and legislation have played a prominent part in recent advances in fruit-growing. The benefits of the application of the results of researches are properly safe-guarded by approximate legislative and administrative measures, with a view to protecting the industry against factors unfavourable to its growth. Such control tends:—

1. To safe-guard the industrial and economic interest of the people from foreign competition,

2. To check the introduction of harmful pests and diseases along with new varieties of fruits or in other ways, and,

3. To maintain economic balance between the grower's expenses and risks and his profits.

Legal restrictions are now a regular feature of the trade control of fruit-growing in most countries. Legislation has indeed transformed fruit-growing conditions in some countries. The cultivation is neat. The handling of fruit is sanitary and the marketing properly organised.

Agricultural co-operation and fruit-growing.—Besides trade control, agricultural co-operation is acting as a powerful instrument in promoting the growth of the fruit industry in many parts of the world. Co-operative fruit-farming, co-operative manufacture of wines and preserves and the preparation of fruit for marketing through co-operation are the growing tendencies of the modern age. Agricultural co-operative facilities facilitate credit, secure specialised staff and obtain favourable terms for the disposal of the produce. The success of Jewish fruit colonies in Palestine, and the fruit-growers' societies and exchanges in the United States of America and Italy are instances where agricultural co-operation has shown profitable results.

The relation of co-operation to the well being of the fruit industry is not fully realised in India. Recently, however, a few co-operative fruit sale societies have been registered, but they are not yet functioning properly.

The trend of recent investigations in foreign countries and India.—Every fruit-growing country has contributed substantially towards the science of fruit-growing. The trend of investigations in France shows that the French workers have struggled to develop those types of grapes which would yield decidedly superior wines and help them to hold their monopoly. Aenological researches, coupled with the evolution of new types of grapes, root studies, frieght against pathogens, soil fertilisation and finding suitable methods of propagation, are the chief lines of experiment in France. All have a common object, viz., to reduce the cost of cultivation and increase the yield in order to bring in more money to the growers. The French workers are also busy on the standardisation of packs suited to various types of fruit. Such improvements are controlled by national committees and the French system of disposal of fresh fruit is skilfully organised.

The Italian Government is also busy improving the quality of fruit with the hope of establishing a wider trade in fruit products. Prompt attention is being given at present to diseases like the 'Mal del Secco' (caused by the organism *Deuterophoma tracheifila Petri.*) disease of citrus plantations, and relief is being given to needy growers by reducing their land tax and other liabilities. Rules and regulations are also being framed to control the import and export of fruit with the hope of protecting their present industry. Foreign fruits cannot land so easily in Italy. Research on pomacieous fruits, genetics and the standardisation of lemon products form an important part of the Italian fruit work. Stress is being laid on the cultivation of nuts. At several places, the Italian growers have organised themselves in order to fight against pests of fruit trees.

Germany, through an industrial country, has contributed greatly towards the science of fruit-growing. Researches on plant growth and plant propagation, root studies, pollination, proprietory fertilizers and their effects on the quality of fruit-breeding and testing of new grape varieties and other such problems have attracted the attention of the German workers. The observations on the technique of cold storage are very valuable.

The United Kingdom, being a great fruit-consuming country, is striving to develop fruit-growing in her territories with a view to reducing fruit import from foreign countries. Efforts to develop fruit-growing in British territories have been very successful. Researches on root stocks, soil deficiencies, gas storage and cold storage, and such other problems have helped the growth of fruit trade. The development of a canning industry has stimulated the extension of fruit cultivation in the

British Isles. The findings of the Imperial Economic Committee (1926) emphasised the importance of fruit growing in the Empire. The promulgation of pure food laws and the national marks scheme have enhanced the market value of British produce, whilst the activities of the Empire Marketing Board have developed the Empire fruit trade considerably. Empire fruits, by virtue of the various Ottawa agreements are admitted into the United Kingdom free of duty, whilst foreign fruits pay duty under the Import Duties Act, 1932.

The discussions at the Imperial Bureau of Horticulture and self-contained fruit experiment stations in the United Kingdom, as well as in other parts of the Empire, are some of the other important items which have led to the rapid progress of the fruit industry in the various parts of the British Empire. The recent list of Scientific workers in the Empire shows that almost every conceivable line of research is being pursued by one worker or another, in at least one part of the Empire. The extension of fruit cultivation in various parts of the Empire is encouraging. The movement of fruit from one part of the Empire to the other is also brisk and the development of the canning industry, specially in the United Kingdom, is phenomenal. All this success has been achieved within a decade. Plant-breeders all over the British Empire are keen on evolving suitable varieties of commercial fruits which will be useful for preserving and which can compete favourably with non-empire products. The economic value of fruit research and organisation in the British Empire can be well judged from the volume of the trade from the West Indies to the United Kingdom and the rapid and successful establishment of the Jewish fruit-growing colonies in Palestine. Nor should one omit to mention the important researches on the 'Panama' disease of bananas in West Indies and varietal trials, crop investigations in relation to soil and climate, cultural methods, plant diseases in South Africa, New Zealand and Australia.

In the United States of America the introduction and breeding of productive types of fruits are being actively pursued. Irrigation and pruning practices and use of fertilizers have undergone a great change. Their investigations relating to the improvement of transport, pre-cooling and storage of fresh fruit as well as canning are conducted on the more approved technical lines. Investigations on frozen pack, preservation of juices by freezing and colouring and softening of fruits by ethylene are considered valuable by the trade. The improvement of fruit crops by bud selection has been accomplished in recent years. Efforts are being made to find better stocks. The principles of evolving fruitful types by

cross-pollination are well understood and practised. The state rules and regulations to control both the import and export and the internal movement of fruit and its products play as important a part as research does in the improvement of the American fruit industry. The development of mechanisation in agriculture has diminished the cost of production and has added materially to the profits of the commercial fruit farmer. The Fruit Bureau Section of the U. S. A. Department of Agriculture and the marketing and intelligence organisation add daily to the economic well-being of fruit-growers. The Government of the United States of America recently introduced a Bill to grant patents to holders of new varieties of fruit plants in order to give a stimulus to growers as well as plant-breeders to breed new types. The same policy is followed in her possessions in the Philiphines and other islands.

Greece is also an important country from the point of view of fruit growing as it specialises in current grapes.

The growing, manuring and drying of fruit have attracted the special attention of the Greecian growers. Greece exports 15,500 tons of currants and raisins annually.

It appears from recent reports and events that Japanese workers are closely following in the footsteps of investigators in other fruit-growing countries in the world. It is surprising to see that during the last three years the import of Japanese apple into the Indian market has increased from Rs. 704 in 1930-31 to Rs- 108, 475 in 1632-33. Japanese researches on citrus crops are leading in many ways.

In India the fruit industry is still in its infancy. There is not much at present in this country which can be claimed as a valuable contribution towards the development of the fruit industry, either in the matter of research or of administrative measures. The importance and necessity of developing this industry have lately been attracting the attention of the agricultural mind. Both the Imperial and Provincial Governments are taking a lead in the matter and are financing fruit research schemes and establishing experimental stations. In Sind this activity is perhaps stimulated by the large irrigation projects in which huge sums have been invested and the move to develop wide tracts of the countryside where ordinary agricultural crops are not financially successful. Up to the present the work on the fruit crops done in India has chiefly consisted in introducing new varieties and giving them a trial under different soil and climatic conditions. Organised fruit research in India dates back to the last quarter of the nineteenth century, but the

progress made so far is not encouraging. A survey of the work done shows that the earlier efforts were sposmodic and lacked that continuity which is so essential. It may be true that these attempts have but poorly subscribed to the economic development of the country, but the importance of the work should not be undervalued, as a beginning had to be made. The paucity of results is largely to be attributed to the fact that only now have self-contained experimental stations beeen established. Much effort is still needed in the way of developing productive varieties of fruits, improvements in propagation and cultural practices and researches relating to the utilisation of crops.

Progress of research and its application to industry requires both patience and finance. The success of the other countries mentioned above is the result of a long scientific struggle entailing large expenditure. In India fruit research has heretofore been of secondary importance in our agricultural development. It is a welcome sign, however, that in recent years some effort is being made to encourage the fruit industry in this country. Fruit has not yet played any part in the export of agricultural commodities on which, it is believed, India's economic prosperity depends so largely.

Looking to the history of the past decade one can safely say that the development of the Indian fruit industry shows a material advance. The first nucleus of this development is seen in the appointment of the Mango Marketing Committee in Bombay in 1925. This was followed by other important steps, which various Provincial Governments and the Imperial Government took to stimulate the growth of this industry. The Punjab Government organised their Fruit Selection in 1926. The Government of Bombay showed their practical interest in the matter by permitting the writer to study the lemon industry in Italy and fig industry in Asia Minor in 1925. They also took the lead in exporting the Indian mango to England in 1932-33, with the financial help of the Imperial Council of Agricultural Research, working out thereby the possibilities of this trade. They further convened two fruit trade and export conferences in 1933, soon after which the Bombay Fruit and Vegetable Marketing Committee was appointed to investigate the marketing of perishable products in this Province. In order to develop the Indian fruit trade, the Imperial Council of Agricultural research in India further sanctioned a large amount of money for carrying out experiments to find out "storage life" of different varieties of mangoes. The Council also finances fruit research schemes in Madras, United Provinces, Bengal, Bihar and Orissa, and in the Central Provinces; Punjab, Mysore, and

Hyderabad schemes have recently been approved. It remains to be seen what results emerge as a result of all these experiments and investigations, but it is hoped that the persistence of Indian investigators and their devotion to this cause will be rewarded by better yields and by the opening of better prospects for the development of the fruit industry.

It is satisfactory to note that material advances have been made recently in the organisation of fruit growers associations in the Bombay Presidency, the Punjab and the United Provinces. The reduction of railway-freight declared by the G. I. P. and B. B. and C. I. Railway Companies on perishable products is another helpful step. Such reductions are badly needed for the development of fruit industry as they give a great impetus to its growth by raising the growers' profits. A fillip has been given to fruit-growing and big fruit orchards managed on modern lines are cropping up in different parts of India and fruit-growing methods are undergoing a change for the better. Our hunt for improved types is also meeting with success. Indian-made fruit products, notably lime juice and jams, are daily gaining ground in the market. Projected schemes relating to the establishment of a fruit bureau and canning laboratories will provide missing links in the chain of progress.

It is thus evident that the ground has been cleared for the development of the fruit industry in India, and it should not take long for Indian investigators to bring their work with the requirements of the industry. Their co-operation with each other as well as the co-ordination of inter-provincial activities will result in improving the resources of the fruit-growers throughout India. Given State protection to the industry, complete agricultural experiment stations, proper marketing organisations and transport facilities, fruit-growing in India is bound to be an important source of wealth to the Indian agriculturists as in other countries.

INDIAN COTTON AND ENGLISH RESEARCH*

In a very interesting survey of the research work carried on during the last year, at the Shirley Institute at Manchester, Dr. R. H. Pickards the Director, mentions the investigations made in connection with Indian cotton. In the course of an article in a special number of Cotton, the official journal of the Manchester Cotton Accociation, Ltd., Manchester he writes that Indian cotton figured largely in public interest.

"This interest of Lancashire spinners in the Indian cotton has naturally been reflected in the increased takings by spinners which have

*The Indian Textile Journal, Vol, XLVI, No, 524, 30th Novr. 1935,

amounted to almost exactly 400,000 bales in the past season compared with some 305,000 in the previous season when the takings were even then much above the average. This large increase has been due almost entirely to a greater demand for the short staple *Oomras* and *Bengals* cottons. It is felt, however, by the Lancashire Indian Cotton Committee that Lancashire does so considerable a trade in medium counts up to 40's that every effort should be made to encourage the industry to use Indian cottons in these counts. In times past American types of cotton have formed the backbone of mixings for the medium counts, but the recently increased use of outside growths has demonstrated effectually that spinners are willing to use any type of cotton so long as the quality of their production is maintained and the yarns can be sold at remunerative prices.

"With this in view the Committee, while recognizing that the better types of Indian Cotton which are available in this country may not be suitable in straight spinnings by themselves to replace the medium counts spun from American cotton, have felt, nevertheless, that there is no adequate obstacle to the incorporation of some proportion, say 25 percent of such better Indian types in the mixing. In order to explore the ground the Shirley Institute has co-operated with the Lancashire Indian Cotton Committee and recently held a second exhibition in which attention was directed primarily to the possibilities in this direction. The American cottons used in spinning the yarns for this exhibition were Texas (Two types) and Memphis the Indian cottons used in the mixings were Punjab-American 4F, Punjab-American 289F, Cambodia, and Tinnevelly. Yarns were prepared from these mixings in a range of counts of 22's.40's, and the exhibits showed how the yarns spun from the mixing compared with the American cotton spun straight. In most cases the mixing contained 25 percent of the Indian cotton though in a few instances the proportion of Indian cotton was raised to 50 percent. The spinning were in 22's, and 40's, and all were spun with twist factor 3¾. These counts were chosen as being those in which there is an extensive trade. The exhibits showed the raw cottons and blends, Baer sorter staple diagrams of the cottons and the measurements made on them, bobbins of yarn spun from the yarn and blends, yarn wound on black boards and also woven as weft into a 5-shaft sateen for the examination of the yarn for levelness, neppiness, and clearliness. A series of charts showed the results of the hair tests, the spinning particulars, and the results of lea test on the yarns.

"All the straight cottons were spun into two counts, the lower count having usually a lower twist-factor than the higher count, which was

twisted for maximum strength. Two of the short staple cottons, a Bengals and an Oomras, were shown spun on serveral different roller systems to indicate how the yarn strength could be improved by careful choice of conditions. The effect of draft at the spinning frame on yarn strength and levelness was also demonstrated. A useful feature of the display was that an examination of the yarns could be made, and then with the help of a system of cross references a visit could be made to the frames on which the yarn were actually spinning—a method that had far more appeal to the practical spinner than a mere statement of fact.

"A factor that has tended to militate against the use of the medium staple Punjab-American cotton has been the very prevalent practice of mixing a proportion of Bengals cotton with it during the process of ginning. When the mixture is baled it is most difficult to detect the exact proportion of mixture by means of the ordinary hand stapling tests; yet the strength and the appearance of the yarn are badly affected by the presence of the Bengals. To illustrate this a comprehensive exhibit was prepared of raw cottons and yarns of Punjab-American cotton containing O, 10, 20, 30, 40, and 50 percent. Bengals. These samples enabled spinners to test for themselves the difficulty of detecting by hand stapling alone the exact percentage of Bengals cotton present. They were also able to see the straight cotton and the various mixing being spun side by side on the mule to 18's counts, which clearly showed how the levelness of the yarn was dependent on the proportion of Bengals cotton. Another series of exhibits consisted of various straight cottons usually *Bengals*, *Oomras*, Punjab-American 4F Broach, Tinnevelly, Cambodia, Punjab-American 289F, the *Verum* and late *Verum* types, the growth of which should so extend as to provide an exportable surplus within the next few seasons, were also on view."

THE HEALTH VALUE OF ORANGES*

In the present article I shall confine myself mainly to one vitamin, viz., vitamin C, but before doing this, it will be necessary to mention the other vitamins as well and give a general description of these substances, since their value is being increasingly emphasized.

Vitamin A, B_1 and B_2, C, D and E are substances which differ radically from one another, and have been designated by alphabetical letters according to the order in which they became known as such

* In *Farming in South Africa*. Vol. X, No. 112, July 1935.

independent entities. It might be explained here that vitamin B was subsequently shown to consist of several different vitamins, which have accordingly been designated B_1 and B_2. Certain scientists, indeed, held that there are seven vitamins B.

Meaning and Incidence of Vitamins.—The necessary constituents for the body are proteins (e. g., meat), carbohydrates (e. g., bread and potatoes), fat, mineral salts and vitamins mentioned above. Fund called these substances vitamins because he thought that they contained the properties of the amines, a particular group of chemical substances. 'Vita' is the Latin term for life, and because vitamins are essential to life, he evolved the name "vitamin" by combining the two words. It has subsequently been conclusively proved, however, that the vitamins are not amines, but the name has nevertheless been retained. Vitamins are divided into two groups, viz., those soluble in fat (A, D and E) and those soluble in water (B_1, B_2 and C).

Vitamin A occurs in natural fats and oils, e. g., butter milk, egg, yolk and raw carrots. This vitamin is most essential to the growth of the body, which would be impossible without it. If the deficiency is such that growth is completely arrested, the eyes become affected. There may even be a vitamin A shortage, however, without any symptoms being manifested.

A deficiency in vitamin B_1 and B_2 is followed by a disease known as beri-beri. The disease is neurits, a degeneration of the nerves. Yeast and vegetable concentrates such as "Marmite" constitute the principal source of this vitamin.

A vitamin D shortage causes rickets, if calcium and phosphorus occur in abnormal quantities or proportions. Vitamin D assists the body in using the two substances to advantage in building up the skeleton, even if the calcium and phosphorus are insufficient or in the wrong proportion. People who spend a good deal of time in the sun need fear no shortage of vitamin D, for sunshine enables the skin to form an adequate amount of the vitamin. The principal source of this vitamin is cod liver oil, which may be strongly recommended for children and babies. To a certain degree egg yolk is also a good source.

Our knowledge regarding E is still most uncertain. It has not yet been determined whether it is essential for humans, but rats, the animals generally used for experimental purposes, have been found unable to breed without receiving this substance in their food; hence the name anti-sterility vitamin.

delicacies. In cooking preserves, attention should be paid to the importance of cooking rapidly, rather than more slowly at a lower temperature. In addition, the container should be kept closed as far as possible during heating and cooling.

It should be noted, further, that sweet citrus fruits contain fructose as well as valuable salts, which are essential to good health.

People who are frequently troubled with heartbnrn are usually under the impression that such fruits will aggravate the position, but this not so, as the juices after digestion have an alkaline reaction. Very few people are adversely affected by such natural foods.

In conclusion, we would point out that although the present article deals principally with the orange, what has been said about it is also applicable, in a lesser degree, to the other citrus fruits. It is impossible to overstate the value of these fruits, and the sooner we export less of our oranges and sell more locally, the better will it be for public health.

SOYBEAN*

(Glycine Hispida.)

By K. P. Sirvastava,

Second Economic Botanist

In this province the Agriculture Department started some preliminary work on the crop as early as 1911. A collection of different varieties from foreign countries was made and grown on the Nagpur farm. Particular attention was given to acclimatize it and to obtain suitable high-yielding early strains, possessing at the same time satisfactory percentage of oil. The work continued for some years but the results obtained were not satisfactory as none of the varieties were acclimatized. Further work was therefore dropped and the growing of Soybeans did not make any headway.

In 1927, the Botanical Section started the investigation of problems relating to fodder supplies and in this connection a large number of leguminous crops including Soybeans were tested. Of the Soybean, two varieties, viz., Java black and Wilson early, gave encouraging results as regards their green fodder value. Java black was found to be more prolific as a green fodder and gave a high yield per acre. To experiments on the yield trials of some of the chief leguminous fodders were continued for three years and the result of these trials and the comparative position which Soybeans attained are given below :—

* Leaflet No. 4 of 1935 Department of Agriculture C. P. & Berar

		Per acre in lbs.
1.	Alysicarpus rugosus (Shevra) ...	20,105 (It gives two cuttings.)
2.	Glycine hispida (Soybean Java ... black).	12,505
3.	Stizolobium (Velvet bean) ...	12,095
4.	Glycine hispida (Soybean Wilson early.)	11,905
5.	Dolichos lab-lab (Popot) ...	10,229
6.	Vigna catjung (Cowpea) ...	8,960
7.	Cymopsis psoralioides (Cluster bean.)	7,805

From the above it will be seen that the Soybean gives fairly high yield of nutritive fodder and that it can easily be grown like any other leguminous crop in the kharif season.

During recent years, simultaneously with the testing of Soybeans for use as green fodder, work in connection with seed production has also been carried on. A large number of fresh varieties from Kalimpong (Bengal), Kuala Lumpur (F. M. S.), Barberton (U. S. A.), Leningrad, etc., were obtained and tested. The object of these experiments has been to find out the varieties which could be suitably grown and which might produce good seed of economic value for use as human food. Of these, three white seeded and one black seeded varieties gave promising results as regards their adaptability, earliness and yield. These types are being grown this year on the College farm on a field scale for multiplication of seed and for finding out the yield per acre in comparison with other leguminous crops like *mung urid* etc.

Further, with a view to find out their nutritive value as compared to that of *mung* and *urid*, these varieties have also been chemically analysed this year and the results are given below :—

Varieties.	Protein.	Oil.	Carbo-hydrate.	Food units.
No. 49 ...	40.38	14.42	28.56	156 2
No. 53 ...	38.33	15.21	29.76	163.6
No. 57 ...	38.33	15.19	29.57	163.4
No. 59 ...	40.61	12.84	29.49	163.1
Mung ...	21.81	1 46	57.96	116.1
Urid ...	24.49	0.73	58.17	121.2

It will be seen that these selected strains are about 1½ times more nutritious than *mung* and *urid* and also contain a high percentage of oil.

All the above experimental facts show that while the Soybean plant provides a nutritive fodder to the cattle, the seed itself can be utilised as a very nutritive food for human consumption, richer in qualities than *mung*, *urid* and other pulses.

With a view to test its taste and other cooking qualities, the selected and acclimatized varieties were distributed for trial in Craddock Town, Nagpur. The report shows that the Soybean is quite palatable and does not suffer from bad taste on account of the high percentage of oil. When ground into flour it can be mixed with wheat flour to make *chapatis*, *puris*, *kachoris*, fritters *(bhajias)* and other Indian preparations. One drawback, however, which has been noticed, is that it does not very well mix with water in the preparation of "dal" like other pulses.

During the year the seed of the selected strains of Soybean was also distributed to some cultivators and others for trial. More seed will be available for further distribution by the end of this kharif season when the crop which is being grown on a field scale on the College farm is ready.

The usefulness of Soybean as an article of food for both man and cattle is indisputable. The only great difficulty which might beset its introduction on a wide scale is that our cultivators being by tradition conservative might take a long time to add a new crop to those already grown, unless they can be persuaded that the crop will bring them more profit per acre. The latter will depend not only on the yield but also on the market prices. As regards the consumers, the factors to determine their choice will be taste and price. If the crop can be purchased cheaper than *mung*, *urid* or gram propaganda in regard to its higher nutritive value ought to be successful in evercoming any prejudice regarding taste, etc. Therefore, the cultivation and use of the Soybean in this province at present will have to be pushed through the enterprising malguzars and other rich and educated persons who are prepared to spend both time and money during the initial stages of its introduction.

Gleanings

(1) Bottle Feedings of apple trees.—Apple trees grow faster when fed on a "bottle" instead of by natural methods. This has been discovered during experiments at East Malling Research Station, Kent, England,

Orchards fertilized in the Ordinary way may not receive full benefit from the fertilizer for several years. Under the "bottle" system deficiencies in the soil can be made good in a few days. A small hole is bored through the trunk of the tree. This is connected by a tube with a tank containing fertiliser in liquid form. One end of the hole is then plugged up, and the tree allowed to absorb fertiliser for a period of from two to three days. (*The Hindu.*)

(2) Feeding The Cow that Fills the Bucket.—" Any good cow will give a pot of milk just after calving-Nature sees to that-but it is what she averages after six months that counts in a 273 days' test," " pointed out Mr. G. F. Shirley, in an address at the recent western district conference of the New South Wales Agricultural Bureau. "Only a good cow will stand that strain, and you can hardly expect an animal that has been deprived of some of the essentials of life in her early youth to be able to stand the racket of high production later on. Dairying is one of these industries where a 'long-distance' view must be taken when laying the foundations for future performers. I have found that many breeders do not fully realise that it is just as important to 'build them right' as to 'breed them right.' You can over-feed, yet stunt, the best bred poddy in such a way that she will never be a producer, whilst surprising results can be obtained from moderately good animals by judicious feeding." (*Queensland Agricultural Journal*)

(3) Rural Hygiene and Health Co-operative Societies in Yugoslavia.—Social workers engaged in "village uplift" in this country will find a great deal that is of interest in the health cooperative movement in Yugoslavia, an article on which appears in the July 1935 issue of the International Labour Review. The movement is still young because it began only in the year 1921, started making real progress after the year 1928 and received legal recognition from the State at the end of the year 1930. A social investigation made in the year 1912 by a private individual showed that the Yugoslavian peasant was uneducated and illiterate and that conditions of sanitation and housing in the villages left much to be desired. About the time the results of this investigation were published was started the first health co-operative society in the country. The movement was started by private individuals who decided to deal with all the aspects of rural problems as one and their programme of work include (a) curative medicine, (b) preventive and social medicine, including hygiene proper and the campaign against infectious and social diseases and (c) rural

sanitation work. In the opinion of the organisers, the only means of attaining the proposed object was co-operative organisation.

The health co-operative movement started with one advantage in that there existed in Yugoslavia various agricultural co-operative societies from the experience and traditions of which this new aspect of co-operation could benefit.

The health co-operative organisation consists of a union and this union had, in 1934,114 societies comprising 44,933 families representing roughly over 270,000 persons. Like all co-operative societies, the health co-operative societies are associations of persons and not joint stock companies. The share capital consists of the members' contributions. The share of each member, as fixed by the rules, varies from ten to 100 dinars each, The usual amount is 50 dinnars. * Further in order to meet possible debts on the part of the society, each member pledges his financial responsibility to the extent of ten times his share. In an increasing number of societies, the working capital also includes supplementary resources, as a result of the creation of a "health fund", which also serves as a sort of insurance against sickness. The amount of each member's payment varies in different societies according to their membership. In principle, payments are made monthly, but in practice generally at harvest time. Members may also pay in kind, that is, in milk, cheese, etc., which is then sold by the agricultural co-operative societies.

In its elementary form, which is still the most usual, the health centre has a doctor and sometimes a nurse or a mid-wife. The doctor lives in the village and his wife is expected to help him in his various duties. Whether consultations are paid for or free, the doctor's salary comes out of the society's general resources. It is as far as possible based on the amount of work done but does not depend on the capacity to pay of the individual sick person. In the village chosen as a centre a few rooms are cemented and these provide a consulting room, a dispensary on a uniform model, one or two other rooms for meetings and lectures and sometimes a room fitted up with shower baths. The co-operative society also rents one or two other rooms, each with three or four beds for persons who are seriously ill.

Apart from the provision made for curative measures, among the preventive measures applied by co-operative societies is vaccination is

* 100 dinars are equal to 6 rupees approximately.

free and public, that is, it is not reserved for members only. Almost all the co-operative societies organise health supervision for infants, children and mothers. It is also the doctor's duty to carry out medical inspection in the village primary schools. Children receive treatment free of charge and the poorest are even given medicines gratis. The health co-operative societies are also actively engaged in combating the more prevalent social diseases such as malaria, tuberculosis, venereal disease, etc,

Village sanitation work, which is of the most varied kind, is in most cases entirely carried out by the villagers themselves. It includes laying pipes and drains, constructing wells, manure pits, latrines, refuse pits, etc.

The programme of work of the health societies is closely interlinked with their educational programme. But they try to keep their educational work in close touch with everyday life and their system is first and foremost concrete and active.

The societies have juvenile and women's sections. The former take part in the sanitary improvement of the village and the latter help to promote tidiness and cleanliness in the house, regular payment of subscriptions and regular attendance at lectures and meetings. The village is divided into a number of groups of houses. Each group is entrusted to a responsible person who gives advice, encourages individual work, generally supervises and makes a report. The women's section are also responsible for organising fetes and concerts and creating a real social life.

The Government of Yugoslavia view with favour the work of these societies and the Act of 1930 besides putting them on a definite legal basis also paid a tribute to them and gave them fresh stimulus. The Act explicitly provides that the Union of Health Co-operative Societies shall receive permanent assistance from the State to be included in the budget of the Ministry of Social Policy and Public Health. The annual grant for this work in the present budget is 250,000 dinars. (*Labour Gazette, Bombay*).

(4) Co-operative farming in Travancore. A practical scheme of co-operative farming and scientific agriculture is to be in augurated by the Government of Travancore. The Government have sanctioned assignment of 165 acres of land in Kunnather taluk to the Koni Karshika Vidyarthi Co-operative Society on certain conditions.

The land to be set apart for cultivation will be marked out by the Director of Agriculture and the Land Revenue Commissioner wlll arrange for the area being sub-divided into blocks of five acres. The lands will be granted only to students who have undergone a successful course of training in practital agriculture at the Koni Agricultural School. One plot for each applicant will be allotted. The tenant should live on the land assigned and carry on farming on scientific and approved lines under the guidance and supervision the officers of the Agricultural Department deputed for the purpose.

A loan not exceeding Rs. 250 under the provision of the Land Improvements and Agricultural Loans Regulation will be granted on the recommendation of the officers, to be utilised for the purchase of seeds, manure, implements, etc. The loan will be repayable in ten equal instalments, the first will fall due at the end of the three years from the date of disbursement of the loan. The officers of the Revenue Department and the Agricultural Department are to see that the amount is spent on the farm itself. At the rate of one acre each by the end of the year, the whole area of five acres allotted to a single individual should be brought under cultivation in five years.

The assignment will be first in the nature of a lease but the land will be assigned to the lessee after the entire amount of the loan advanced, if any, is recouped on payment of Tharavila and assessment to be fixed at at the time of such permanent assignment. The land is to be enjoyed free by the lessee during the first two years but the lessees shall, till the registry is completed, pay an amount more or less equivalent to the tax leviable on the land under the revised Puduval rules.

Applications for the lands have to be made to the Director of Agriculture who will sanction the leases and make arrangements for the realisation of the rent and the loan in instalments and remit the same to the credit of the Revenue Department. (*The Hindu*).

Current Research

(1) Life History of Gram Blight and its control in the Punjab:—By Jai Chand Luthra and other (*Agric. and Live Stock in India Vol.* V Page 489, September 1935)

The blight disease of gram is very serious in Attock and Jhelum districts of the Punjab. The symptoms of the disease have been described. The disease is caused by the fungus *Ascochyta rabiesi* (Pass) Lab. *Phyllosticta rabiei* (Pass) Trot. The maximum, optimum and minimum temperatures for germination of spores and growth of the fungus are 32·5°C, 20°C, and below 10°C. respectively. The disease is carried over from one season to the other by (a) sowing infected seed and (b) by the diseased·plant debris which remains lying on the surface of the soil after the crop is harvested. The disease spreads from plant to plant and field to field by secondary infection carried by spores and the diseased parts of gram plants. The spores of the fungus are not blown by wind in dry weather factors, such as rain-fall, temperature, wind and system of cropping, which affect the spread and development of the disease during the growing season, are described.

The following measures have been found effective for the control of the disease and are recommended to farmers:—

(a) Use of disease-free seed.

(b) Elimination of diseased plant debris by—

(*i*) Harvesting the crop by pulling out the plants with hand.

(*ii*) Ploughing the fields once with a furrow-turning plough after the first shower of rain in summer to bury the remnants of diseased plants.

(*iii*) Sweeping the threshing floors and burning or burying the collected debris.

(*iv*) Not making *bhusa* stacks in fields.

(c) Mixed cropping of gram, with wheat, barley, etc.

A comparison of the feeding values of grass ensiled by the A. I. V.—Process and a Ration containing Mangolds and Hay. J. B. E. Patterson, *Emp. Jour. Expt. Agri.* Vol. III No. 10 April 1935.) Mature aftermath growth was ensiled by the A. I. V.—process. The analytical values for the fresh grass and the A. I. V.—fodder show that little change occurred in the content of protein, though the values for phosphoric acid and calcium are lower in the silage. No estimate of the losses can be made since the grass was not accurately weighed when filled into the silo and the total weight of A. I. V.-fodder is not known. A feeding-trial was carried out with South Devon diary cows on the period-reversal system 40 lb. A. I. V.—fodder replaced 40 lb. mangolds and 5 lb.

hay. The milkyield during the A. I. V.-fodder feeding-period fell by 1: 2 lb. per cow per week compared with values of 7.7 lb. and 4. 4 lb. during the preceeding and following control periods. There was a pronounced fall during the transition period when the cows were being brought on to the A. I. V.—ration. This was only partly due to the change of ration, since the milk-yield of the rest of the herd fell sharply at the same time due to a severe spell of cold weather. The average percentage butter-fat was slightly, but not significantly, higher during A. I. V.—feeding 4.34 per cent compared with an average of 4.27 per cent before and after. The colour of the butter-fact was more than doubled during A. I. V.—feeding. The live-weights of the cows fell during the control periods and rose to slightly above the initial weights during A. I. V—feeding.

(2) Helminthosporium diseases of barly aud the methods of their control.—M. Mitra and R. D. Bose *(Ind. J. Agric. Sci.* 5,449;) Three species of *Helminthosporium* occur on barley in India, viz. H. *Sativum* P. K. and B. H. teres Sacc. and H. *gramineum* Rabh. H. *sativum* is common at Pusa and its neighbourhood every year. It is responsible for 'foot-rot' and 'root-rot' head blight and spot formation in all aerial parts and does a good deal of damage to the crop. It lowers the percentage of seed germination, The affected plants are stunted and the leaves are discoloured, followed by the shrivelling up of the grain and a reduction in the yield. The fungus is seed borne and persists in the debris of affected plants in the soil. Wheat and some of the grasses are also affected by it H. *teres* also occurs in Pusa but is restricted to such types as have been introduced from outside. It is absent altogether on the local types of barley grown about Pusa. H. gramineum is very rare in Pusa. Investigations carried out at Pusa for the past five years have shown that environmental factors play an important part in the incidence of disease due to these two organisms and that the severity of the disease varies from field to field and even in the different parts of the same field. Varietal difference in the degree of attack on the different types was also noticed. Early varieties seemed to suffer less. The degree of attack varies from season to season. The percentage of leaf area destroyed by H. *sativum* and H. *teres* in the various varieties was determined and in both the introduced and the Pusa varieties there are type which show considerable resistance to the disease. Fungicidal dusts and liquids have been used to reduce the loss but none has so far been found to completely check the disease. While disease in the seedling stage has been controlled to some extent, it has not been possible to check secondary infection at heading time from the infective material already in the soil or from other hosts. Since the disease,

especially the secondary infection, cannot be effectively controlled by seed treatment alone, the necessity for evolving new types resistant to the disease becomes apparent. The use of existing resistant varieties and breeding of new types with more suitable agronomic characters is, therefore, one of the most promising methods of preventing Helminthosporium disease. This method is receiving the attention it deserves. In addition to breeding resistant varieties, it is advisable to plant clean seed and to have crop rotation in order to reduce the possibility of infection from the soil (*Authors' abstract.*)

(4) Some aspects of marketing and cost of transportation of cotton—by A. Singh and P. S, Bhullar (*Agric.* and *Live stock in India* Vol. V. Page 692 Novr. 1935) Only 22.7 per cent of kapas that came to the market belonged to the growers, the rest of it was marketed through middleman. In the beginning of the season more cotton came to the market through middlemen. As the season advanced the proportion of kapas marketed direct by growers increased. A greater proportion of Kapas grown in the neighbourhood of the market is marketed directly by the growers. From long distances more cotton comes to the market through middlemen. Average load per cart come to 26 mds. 29 srs. and average distance travelled to 16.1 miles. Nature of the road does not affect the cost of transportation very much for short distances. It has its effect, however, for long distances. Difference between the village and the market rates, after deducting the cost of transportation and marketing was found to be Re. 1/4/ per maund in Desi and Re. 1/10 per maund in American cotton, which works out to be about 1.5 per cent of the village prices and does not appear to be excessive considering the risk and trouble involved in marketing.

(5) Causes of fluctuation of area under cotton in the Canal Colonies of the Punjab.—By S. S. Jaggi (*Agri. and Livestock* Vol. V Page 712 Novr. 1935) The area under cotton in the canal-irrigated tracts varies considerably from year to year. There may be as much as 90 per cent variation between two consecutive years as in 1914-15 and 1915-16 in case of Lower Jhelum Canal Colony. The main factor responsible for this variation is the price of cotton during the previous year. The co-efficients of correlation between these two variables have been worked out and are given on page 713. The correlation between the yield per acre during the previous year and the area under cotton, when both Desi and American cottons are taken together, is insignificant. If, however, the American cotton alone be taken into consideration, it has been found that a low

yield per acre is followed by a decreased area under this crop. The effect of this factor has been studied statistically. The area under sugarcane does not seem to affect the area under cotton when we take the whole tract into consideration. However, if we take only those villages into account (as in Lyallpur District) where sugar cane and cotton are grown by the same cultivator, it is clearly shown that an increase in area under sugarcane brings about a decrease in area under cotton and *vice versa*. There is usually enough water in the Punjab canals at the sowing time of cotton but in some years such as 1914-15, 1920-21 and 1921-22 scarcity of canal-water also becomes a limiting factor with regard to the area under cotton.

(6) Some soil-heterogeneity trials at Pusa and the size and shape of experimental plots.—By R. D. Bose (*Ind. J. Agric. Sci.* 5,579) Results are reported of soil-hetrogeneity experiments conducted for three consecutive years in the same field at Pusa with barley, wheat and lentils. The co-efficient of correlation between contiguous plots was employed as an index of soil hetrogeneity according to Harris'method and 1 x 5 and 2 x 5 combination plots were made up for this purpose. Although the coefficients of correlation for these two kinds of combinations were not significantly different from one another the presence of significant co-efficients for each combination denotes definitely that the field under consideration was not absolutely uniform. Fisher's analysis of variance was also employed to determine the drift in the fertility of the field with the same data. It was found that there was a great deal of variation in the yields for columns and very little in the rows suggesting that there was a fertility gradient in this particular field which ran from west to east. This was further seen when contour maps of soil fertility were drawn from results of plot yields. It is shown that Harris' method of determining soil-heterogeneity provides a measure of heterogeneity present in the whole field but Fisher's analysis of variance not only provides a measure of soil-heterogeneity but also clearly sets forth the direction of the fertility gradient and should, therefore, be a more comprehensive method for such work. A knowledge of the amount and direction of variability in the fertility of any experimental field helps in the proper laying out of yield or manurial trials in the right direction and give as measure of the size and shape of plot which ought to be employed. The results of the wheat trial have been employed to illustrate this fact. (*Author's abstract.*)

Crop Forecasts

1935-36

LINSEED

First forecast for Central Provinces and Berar.—On an average of the five years ending 1933-34 the area under linseed in the Central Provinces and Berar represented about 25.3 per cent of the total area under the crop in British India.

The Sowing of linseed commenced at the normal time in October throughout the province except in the Mandla and Balaghat districts where it was early. The early monsoon rains were heavy and prolonged till the first week of August. During the latter half of August there were intervals of clear weather with sunshine. The favourable weather in September with intermittent light to heavy showers all over the province and the break in October afforded time for the preparation of rabi land. The break in the monsoon, however, continued and with unusual heat in October there was a lack of sufficient moisture in the soil by the end of November. Sowings were made generally under favourable conditions and germination was successful though a little resowing was necessary in a few places in the Saugor and Hoshangabad districts on account of rain soon after sowing. The total area sown in the Central Provinces and Berar is estimated to be 968,346 acres and is greater than the corresponding area of last year, viz., 946,459 acres by 2 per cent but falls short of actual area (997,222 acres)by 3 per cent. The condition of the crop is at present fairly satisfactory but the absence of dew and winter showers is likely to affect the prospects of the crop.

RICE

First Forecast for Central Provinces and Berar.—On an average of five year ending 1933-34 the area under rice in the Central Provinces and Berar represented about 6.5 per cent of the total area* under the crop in British India.

Area—The estimated area of 5,664,349 acres in the Central Provinces and Berar together is larger than the actual area of last year (5,631,074 acres) by 33,275 acres. It also exceeds the quinquennial and decennial averages by 2 and 4 per cent, respectively.

Outturn—The abrupt cessation of the monsoon since the last week of September coupled with unseasonable heat in October damaged the crop

on light soils and in unirrigated areas. The late rains were too scanty to bring the crop to full maturity. In the Drug and Raipur districts, the estimated outturn stands at 82.5 per cent while in Bilaspur and other important rice-growing districts, it ranges from 90 to nearly normal, except in Chhindwara where it is only 75. For the province as a whole, it works out to 88 per cent of the normal or 11.7 annas as against the final estimate of 107 per cent last year. According to the estimates of areas and percentages of outturn reported by districts and the standard outturn per acre in each district the estimated yield for the province as a whole is expected to be 1,484,400 tons which is 16 per cent or 273,000 tons less than the actual yield (1,757,400 tons) of last year. It also falls short of the quinquennial and decennial averages by 10 and 5 per cent, respectively. This is the first year since 1931-32 in which the final estimate of outturn of rice is less than 100 per cent or 13.3 annas. The wholesale price of rice per maund of 40 seers in the important rice districts of Jubbulpore, Bhandara, Drug and Raipur ruled from Rs.2-9-0 to Rs.3-5-0 on the 30th November 1935 as against Rs.2-13-0 to Rr.3-4 0 on the corresponding date of last year.

COTTON

Third forecast for Central Provinces and Berar Note.—On an average for the five years ending 1933-34, the area under cotton in the Central Provinces and Berar represented about 19.0 per cent of the total area under the crop in British India.

Local showers were received in the province in the second week of June but the regular monsoon, which was weak at the outset, did not set in till before the third week of that month. The rainfall in July was continuous and heavy and there was no definite break in the rains till the end of first week of August. The continuous rains of July checked the then growth of the plants and interfered with weeding and intercultural operations. The crop of low-lying and heavy soils suffered the most. The break which set in during the second fortnight of August saved the crop and enabled weeding and intercultural operations to be carried out. The outlook at this stage was satisfactory, but a set-back occurred early in September, when heavy rains again fell in most of the cotton growing districts. The weather during October and November was clear with little or no rain and the almost complete cessation of the monsoon so early was again unfavourable to the crop. The early monsoon rains were too prolonged for the crop on heavy soils and the late rains were too scanty for the crop on light soils.

The current year's estimated area (1,317,753 acres) in the Central Provinces exceeds the last year's actual area by 2 per cent, while in Berar it (2,911,424 acres) falls short by 2,462 acres. The area (4,229,177 acres) for the province as a whole is greater by 1 per cent than the actuals of the previous year but falls short of the quinquennial and decinnial averages by 7 and 12 per cent, respectively.

For the Central Provinces and Berar together, the estimated outturn works out to 69 per cent of the normal which may be compared with 55.5 per cent, the final forecast of last year. The estimated yield by railway blocks for the current season is as follows:—

Block.	Bales.
Jubbulpore.	1,000
Nerbudda.	19,100
Nimar.	83'700
Satpura.	19,300
Nagpur.	105,100
Chhattisgarh.	500
Berar	532,800
	Total....761,600

Review

Phalonki Kheti our Vyavasai: by N. D. Vyas L. Ag., Published by Narayan Dulichand Vyas, Imperial Institute of Agricultural Research Pusa.

Mr. N. D. Vyas L. Ag. of the Imperial Agricultural Research Institute Pusa, deserves to be congratulated on his work "*Phalonki Kheti our Vyavasai*" (cultivation of fruits). The book is undoubtedly a very valuable addition to the scanty literature on the subject in Hindi and should prove very useful to all interested in the cultivation of fruits. The author has lucidly treated all the important aspects of the subject and the volume is a worthy companion to his previous work *Sagbhajiki Kheti.*

One may differ from him in his conclusion that oranges budded on Jamberi will have loose skinned, bigger, slightly sour and reddish fruits

while those budded on sweet lime will have sweet, yellowish, tight-skinned fruits.

Experience in Nagpur shows that the quality, size, colour shape and taste mostly depend on other factors, such as soil condition, age of trees, manure and irrigation, and the number of fruits borne on the trees. On the same tree one branch may have light-skinned fruits of smaller size while another branch may have loose skinned and bigger fruits.—R. N. S.

Calendar of Operations

BY R. N. SINHA,

FLOWERS

February.—Budding operation, if not already completed could be continued till about the third week of this month.

Chrysanthemum suckers will be getting ready for transplanting and they may be planted in small pots, 2 or 3 in each pot, if early and big flowers are desired.

Flower seeds recommended in the last month for summer season may be sown in this month if not already done so. Cosmos seed would do well along with the other ones.

Dablia bulbs may be removed from the pots and after drying them in shade for a day or two may be preserved in a pit containing fine clean sand.

Caladium bulbs could also be preserved with Dablia bulbs or they may be allowed to remain in pots in a heap and covered with a good quantity of dry leaves.

This would be a proper time for putting poinsettia cuttings.

March.—Seeds of the cold weather flower annuals will be getting ready and they should be collected, cleaned, well dried and kept in air tight tins or well corrected bottles for next season's use.

Chrysanthemums left without repoting in the last month may be taken up as early as possible.

Poinsettra cuttings if not already put in the last month may be put in now without much delay.

Hippeastrum lilies may be repotted or top dressed. If they were repotted last year, top dressing would do, as repotting of these every year is not desirable.

Flower seedlings ready for transplanting may be transplated as early as possible for summer use.

April.—Empty flower beds may be dug to a depth of about 1½ feet and the excavated soil left open to sun for exposure.

Delicate plants such as palms, crotens, arelias, draceanas colecs ferns etc. may be shifted to a partial shady place for protection from strong sun and hot winds.

VEGETABLES

February.—The following Vegetables may be sown this month.

Karela	Brinjal
Bottle gourd	Gowar
Turai	Bhendi
Dilpasand	Country greens
Cucumbers	

Mint, may be transplanted. Goat—dung manure is considered to give good results.

March.—The Vegetables recommended for the last month may be sown again for successive crops. Cholai (Asparagus beans) may prove a useful addition to the other vegetables i. e. those recommended for the last month.

April.—If necessary the Vegetables recommended in the last month may be sown for obtaining successive crops, particularly Cucumbers and Country greens.

The plots after the removal of the crops may be ploughed and left for exposure to sun and air.

College and Hostel News

Our New Principal.—We offer a hearty welcome to Mr. E. A. H. Churchill who has been appointed Principal to succeed Mr. J. C. Mc Dougall. Mr. Churchill is not altogether new to us. He officiated as principal for a short period in 1930. Mr. Churchill comes to us with a long record of experience as Assistant Director and Deputy Director in the wheat tract of this province, where he has established a reputation as a sympathetic and conscientious officer. We wish him all success in his new appointment.

An enterprising Alumnus.—We are glad to hear that our old boy Mr. Hemendra Kumar Sen who graduated from our College in 1933 has started private farming at Japla in Bihar. He has leased out a large area of land from the late Syed Hasan Imam of Patna who was anxious to settle a few young men of ability on his extensive estate. The soil and climatic conditions being similar to Nagpur Mr. Sen has started a big orchard of Nagpur *Sunthras.* He is also growing *papayas guavas* and pine apples for which there is a good market in the neighbourhood. He is also growing plenty of vegetables and a portion of the land is devoted to arable farming. In addition he is also keeping a small poultry and dairy in his farm. Mr. Sen tells us that he has started with great hopes and so far he feels sure of success. For the benefit of those who wish to communicate with him we would point out that he has now assumed the name of Nirmal Kumar Sen by which name he was familiar amongst his friends here. We wish him all success in his enterprise.

Social Gathering.—The annual Social Gathering of the College was celebrated on the 22nd and 23rd of December 1935. The celebration started on the morning of the 22nd with the reception of the old boys and the members of the staff in the College hostel. This was attended by a large number of old boys and some of them spoke about the activities and social functions during their times. This pleasant function was brought to a close by proposing a toast to all the old boys present by the general secretary.

The guests and the students of the College then moved on to the tennis Court to witness the tennis finals. The matches were very interesting and well contested.

The noon was occupied by a cricket match between old boys and members of the staff on one side and the present students on the other, where we had the rare chance of witnessing the experienced old hands

frequently sending balls boundary after boundary. Messrs. K. S. S. Iyer, B. S. Rao, M. A. Rahim and Paranjape deserve special mention for the excellent skill they showed in the game. The present students had to yield before the good bowling of Mr. M. A. Rahim. The scores, when the wickets were drawn in the evening, were as follows:—

Old boys and staff ... 175 runs.
Present students ... 140 „

The next day's function opened with the volley ball finals between the second and fourth year students. This interesting match was attended by the Principal, the members of the staff and most of the students. The fourth year team had to yield before the superior skill of the second year. The noon was occupied by the elocution competion. At 3 P. M. a farewell address was presented to Mr. J. C. McDougall by the staff and students of the College. After the general secretary had read the address Mr. McDougall was garlanded and he made a short speech in which he assured us of his help for the improvement of our institution.

The address and prize distribution ceremony was presided over by Mr. P. J. H. Stent I. C. S. Commissioner, Nagpur. The function was attetded by the students and staff of the College and some of the leading citizens of Nagpur interested in agriculture and the Agricultural College. The Principal opened the proceedings with a short speech in which he introduced the president to us.

The general Secretary then read a short account of the social activities during the year. He also dealt with the necessity for certain important reforms in the hostel and its neighbourhood. This was followed by the distribution of prizes and medals by the president.

The President then gave an interesting and effective address on the practical application of agricultural knowledge from his past experience.

The President and the guests were then garlanded and the party moved on to the grounds of the Research Institute where Mr. Churchill was At Home to the guests.

The last function of the social gathering took place at night when a variety entertainment was given by Mr. Gunvant Rao of Nagpur.

College Prize Winners

4th year

1.	The Smithy's Chemical Medal.	V. G. Vaidya.
2.	The Napier Essay Prize	V. G. Vaidya.
3.	The Kedarnath Rai Prize for Engineering.	M. M. Khirey.
4.	Special Prize in Agriculture.	V. G. Vaidya.
5.	Special Prize in Entomology.	V. G. Vaidya.
6.	Special Prize in Botany.	K. G. Joshi.
7.	Special Prize in Veterinary.	T. P. S. Chaudhary.

3rd year

1.	Best all-round student, class Prize	T. J. John.
2.	Phatak's Prize in Agriculture	T. J. John.
3.	Kalidas Chaudhari Medal for Practical Agriculture	H. N. Singh.

2nd year

1.	Coronation Commemoration Prize best all round student.	S. S. Kufalikar.
2.	Special Prize, best all round.	S. S. Kufalikar.
3.	Class Prize for Elementary Science.	S. S. Kufalikar.
4.	Class Prize for Mathematics and Survey.	S. S. Kufalikar.
5.	Class Prize for Agriculture.	K. V. Tathode.
6.	Chakradeo Prize, Practical Agriculture.	V. T. Tanksale.

1st year.

1.	Special Prize best all round student.	P. M. Shrivastava.
2.	Class Prize General Agriculture.	M. K. Reddy.
3.	Class Prize Practical Agriculture.	M. K. Reddy.
4.	Class Prize Mathematics and Survey.	Asgar Ali Raja.

Interclass Ploughing Competation Medals won by the 4th year 1934-35.)

1. B. S. Venu Gopal Rao.
2. S. N. Walkade.
3. K. G. Joshi.

The College Debating Society.—The third and the fourth meeting of the society were held during the months of November and December.

The former one was held on Sunday the 24th November 1935 with Mr. B. R. Phatak in the chair when Mr. V. S. Gokhale L. Ag. (Hons) an old boy of our college delivered a lecture on "The Aim of Life of the Agricultural College Student." The meeting was attended by the majority

of the students. The lecture was an interesting one and the lecturer tried his best to impress upon the students the responsibilities which they should bear in mind after they have passed out of the college.

The fourth meeting of the Debating Society was held on Friday the 20th December 1935 with Mr. B. R. Phatak in the chair when Mr. D. V. Bal, Agricultural Chemist to the Government of C. P. delivered a lecture on the "Soil Science problems recently discussed during the session of the Inter-national Congress of Soil Science held at Oxford in July 1935". The learned lecturer in the course of his lecture said that the International Congress of Soil Science meets once in five years and this time he was requestsd to represent India in the Congress. The following six subjects were discussed by the representatives in the Congress:—(1) Soil Physics (2) Soil chemistry (3) Bacteriology (4) Soil fertility (5) Forest Soils and (6) Alkali soils. He also discussed some of the above mentioned subjects in details giving examples of different soil samples from various parts of the world. The lecture was particularly useful to the students of the senior classes.

The College Gymkhana.—This year the College annual sports were not held during the time of social gathering, as is usually the case, but were held in the morning and evening of the 23rd November 1935. All items were well contested and the competitors showed great keenness. The function was attended by all the students and members of the staff, and the competitors were well encouraged. Our thanks are due to Mr. E. A. H. Churchill who awarded a championship Cup for the best Tennis player of our College. This was won by Mr. M. K. Deoskar this year. Our thanks are due also to Mr. K. P. Shrivastava for the champion's cup he has awarded to the best all round sportsman of our college. This was won by Mr. R. L. Gupta. We sincerely thank Messrs. B. Subba Rao and K. S. Sheshadri Iyer for the encouragement they have given by presenting a silver cup to the best cricketeer Mr. M. K. Deoskar of our college. This list of prize winners is give below :—

Items of competition.	*First Prize.*	*Second Prize.*
100-yards flat race.	R. L. Gupta.	D. V. Narayan Rao.
Long Jump.	G. K. Bhake.	P. M. Shrivastava.
Hurdles.	G. K. Bhake.	R. L. Gupta.
High Jump.	P. M. Shrivastava	G. K. Bhake.
One Mile Race.	B. T. Wankhade.	R. C. Belsray.
Putting the shot	D. V. Narayan Rao	E. N. Dilraj.

		P. M. Shrivastava.
220 yards flat race	R. L. Gupta.	P. M. Shrivastava.
Sack race.	R. C. Belsray.	D. R. Yadava.
Relay race. 1st year.	D. P. Tewari.	
	K. K. Wadu.	
	N. B. Gupta.	
	D. V. Narayan Rao	
440 yards flat race.	R. L. Gupta.	N. B. Gupta.
3 Miles race.	R. C. Belsrey.	Asgar Ali Rajr.
½ Mile race.	R. L. Gupta.	N. B. Gupta.
Tennis championship cup.		M. K. Deoskar.
Tennis singles runner up.		H. N. Das
Tennis double championship.		H. N. Das.
		D. D. Moharikar.
Best hocky player.		R. L Gupta.
All round sportsman championship cup.		R. L. Gupta.
Extempore elocution competition.		M. S. Nair.
		U. G. Deshpande.
Recitation competition.		P. R. Rodey,
		T. G. Deshpande.

Owing to the efficient management of our secretaries all the games were played well this year excepting football which was rather dull this year. In cricket many matches were played and we won the majority of them. The last match we played was against the morris college in the Koria Durbar Cricket Cup Competition where Mr. M. K. Deoskar scored the highest number of runs in our side.

As regards hocky the general results of the matches during the year were fairly good; our college eleven gave a very good stand against the Morris College team in the University tournament played in takli ground.

This year there has been an addition of many new members in the Tennis Club and all the three courts are running in full swing.

Indoor games suffered considerably as the recreation room is occupied by the students due to want of sufficient accommodation in the hostel.

Hostel Library.—This year our hostel library received 23 books from the college office after the lapse of 6 or 7 years. We sincerely thank Mr. Thoy, Librarian Victoria Technical Institute for his kindness in presenting 9 valuable books to our hostel library. Our thanks are also due to Mr. S. B. Gokhale Advocate, Nagpur for presenting 15 copies of a bulletin on fruit culture and a Human Physiological chart to the hostel library.

4th year Educational Tour.—During a short tour in October they visited Chandkhurai and Lablandi farms in Chhattisgarh division. At their first halt at Chandkhuri farm Mr. D. R. Maharikar D. D. A. Eastern Circle enlightened the students by a short but very useful lecture in the course of which he dealt with the present condition of the cultivators, labour supply, the condition of cattle, the principal crops grown and the marketing facilities. Then the students went to Lablandi farm where Dr. Mukherjee Biochemist, Rice Research Scheme spoke about the experiments and progress made in Rice Research. There was also another short excursion in which some of the students of our college went with Messrs S. B. Gokhale Advocate Nagpur and S. K. Misra, lecturer Animal Husbandry and Dairying, to Bina a village of horticultural importance.

The fourth year students had another tour in Berar in Januray. They went first to Ellichpur where there is an important cattle breeding farm. This farm maintais pure Hissar breed. The students had also an opportunity of seeing a collection of white Leghorn birds maintained on the farm. Then they went to Akola. In the course of their stay at Akola they were shown round the farm which is designed on the most modern type with the farm buildings in the centre of the farm. Then they were shown the cotton market and the Verum pooling centre. They also visited the Laxmi Oil Mills, ginning factories, soap factories and Mr. Garrison's poultry farm which maintaines three different breeds of birds namely white Leghorn, Austrolorps and Rhode Island.

Departmental News

Mr. E. A. H. Churchill, I. A. S., Deputy Director of Agriculture, Northern Circle, is appointed to officiate as Principal, Agricultural College, Nagpur.

On relief by Mr. E. A. H. Churchill, Mr. J. C. McDougall, I. A. S., officiating Director of Agriculture, Central Provinces, ceases to perform the duties of the Principal, Agricultural College, Nagpur.

* * * *

On return from leave, Mr. Govind Prasad, Extra Assistant Director of Agriculture, is reposted to Jubbulpore and is placed in charge of the current duties of the Deputy Director of Agriculture, Northern Circle, Jubbulpore, in addition to his own duties.

* * * *

On return from the leave granted to him, Mr. D. V. Bal, Agricultural Chemist, Central Provinces, is reposted as Agricultural Chemist, Nagpur.

On relief by Mr. D. V. Bal, Mr. A. R. P. Iyer, Extra Assistant Director of Agriculture, attached to the Chemical Section, ceases to hold charge of the current duties of the Agricultural Chemist, Central Provinces.

* * * *

Mr. S. G. Mutkekar, Deputy Director of Agriculture, Western Circle, Amroati, is granted leave on average pay for fifteen days with effect from the 2nd January 1936, with permission to prefix to the leave the Christmas holidays and New Year's day from the 24th December 1935 to the 1st January 1936.

Mr. N. G. Sule, officiating Extra Assistant Director of Agriculture, Amroati, will hold charge of the current duties of the office of the Deputy Director of Agriculture, Western Circle, in addition to his own duties during the absence on leave of Mr. S. G. Mutkekar.

OBITUARY

We have to intimate with deep sorrow the death of Mr. Gokul Prasad Sonakia, Agricultural Assistant, which sad event took place on the 27th January, 1936. He was ill for some time and was on four months leave.

We offer our heart-felt sympathies to the bereaved family.

The Nagpur Agricultural College Magazine

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MAY 1936

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The Nagpur Agricultural College Magazine

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Editorial

DEBT CONCILIATION IN CENTRAL PROVINCES

Amongst the various measures adopted for the relief of agricultural indebtedness in this province the appointment of Debt Conciliation Boards has uudoubtedly been the most effective. It is certainly a matter for legitimate pride that our Province has been the first to start on this bold step at a time when the other Provinces were very sceptical about its usefulness. The success of the Central Provinces Debt Conciliation Boards has attracted the attention of the other provinces and states, and most of them have either established or, are contemplating the establishment of, such Boards for scaling down the debts of the agriculturists.

Debt conciliation in Central Provinces is based upon voluntary settlement but the Boards constituted under the Act have a statutory existence and possess certain powers of the civil court. Their jurisdiction may extend to one or more tahsils or some times even a whole district. The Board generally consists of eight influential non-officials of the locality presided over by an official of the status of a Sub-judge. There are just one or two provisions in the Act which may be said to possess an indirect element of compulsion. For example if a creditor refuses a fair and

reasonable offer he shall be deprived of his costs in any subsequent legal proceedings in respect of that debt. Secondly, no interest will be allowed in excess of simple interest at six per cent from the date the Board has issued a certificate to the effect that the creditor has refused a reasonable settlement. Again the recovery of claims of creditors who have agreed to conciliation receive precedence over others.

The procedure of the Board is very simple. Lawyers have been excluded though parties are allowed to be represented by agents. Both debtors and creditors can apply to the Board and if the Board is satisfied that it is desirable to effect a settlement the creditors are then called upon to submit all relevant accounts. These are then scrutinized and the debtors income is ascertained. Efforts are made to reduce the debt so as to bring them within the paying capacity of the debtor. Instalments are then fixed so as to bring the amount within the debtor's annual surplus. In cases where the debt is too heavy to be liquidated from annual income within a reasonable number of years the Board uses its influence to satisfy the creditor either in part or for the whole by the transfer of land. If the creditors accept a fair offer made by the Board they need not go to the civil court for recovering the instalments fixed as they are to be recovered by the Deputy Commissioner on their behalf as arrears of land revenue. This is one of the main inducements for conciliation held out to creditors.

The Act has recently been amended so as to bring even secured creditors under the effective control of the Board. According to the original Act if a secured creditor agreed to participate in an agreement his mortgage lien on the assets of the debtors would be extinguished and this brings him on a par with the unsecured debtors. It has now been provided that if a secured creditor joins an agreement his mortgage lien on the assets of the debtor shall subsist until the amount due to him has been paid or the property has been sold for the satisfaction of such debt.

Up to the end of December 1935 the Boards conciliated debts amounting to Rs. 167.19 lakhs for Rs. 96.07 lakhs giving a remission of 42 per cent. In 264 cases, for claims amounting to 26.55 lakhs, certificates under section 15 (1) of the Act were issued stating that the creditors have refused reasonable settlement.

The extent to which a creditor could be induced to compound a debt depends to a large extent upon the prospects of immediate payment of the debt in cash. In order to facilitate this, Land Mortgage Banks were established in certain centres to give long term loans to those whose debts have been compounded. But these Banks are not being used to any considerable extent; the reason being that while no interest is charged on the compounded debt payable in instalments to a creditor, interest has to be paid on loans taken from the Land Mortgage Banks and it is said that the extra reduction in the debt on account of immediate cash payment is not commensurate with the amount that has to be paid by way of interest to the bank.

The Boards are gaining in popularity and there is a growing demand for establishing more Boards. The great rush of applications for conciliation from both debtors and creditors is an indication that these Boards are meeting a genuine want. Work has already been completed in certain centres and about 28 Boards are working at the present time. When the Debt Conciliation Bill was introduced in the Council it was adduced against the Bill that it would cause hardship to the agriculturists by creating a sense of insecurity in the minds of the creditors and making them unwilling to lend. So far there is no evidence to show that there has been a reduction in the sources of credit available to the agriculturists. The money lenders are undoubtedly more cautious but this is not an unmixed evil. It will compel the agriculturists to live within their normal income and avoid squandering money on ceremonies and pilgrimages.

Original Articles

POWDERY MILDEW ON ROSE

By K. A. Mahmud, B. Sc.,

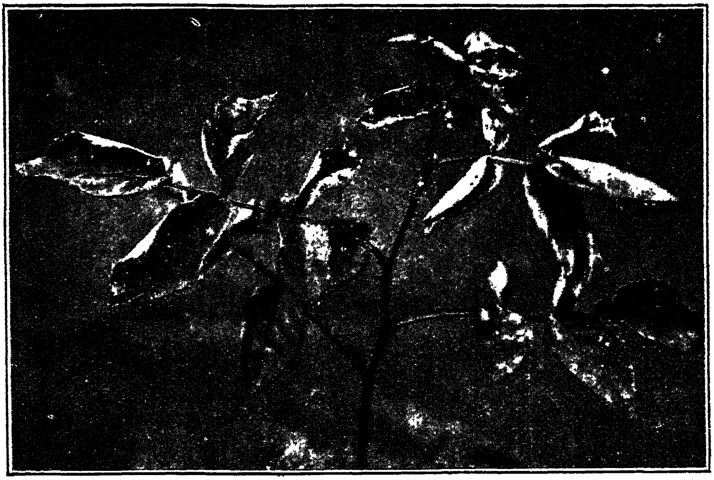
(*Assistant to Mycologist to Government, C. P.*)

Powdery mildew (*Oidium leucoconium* Desm.) is one of the serious diseases of the rose plant in this Province. The disease may be seen at Nagpur almost every year, though it occurs in an epidemic form only occasionally. Severe out-breaks of this disease were noticed only twice during the last six years, in the years 1930-31 and 1933-34. The disease is usually first seen in November; it does most damage in January and finally disappears about the end of March when the dry season sets in. The disease does most damage chiefly in moist, cool season, or in the neighbourhood of water-logged areas.

Description.—Powdery mildew of rose infects young and newly formed aerial parts of the plant. It usually attacks young leaves on the upper surfaces of which appear tiny raised spots having depressions at the corresponding points on the under sides. These spots soon become covered with a white powdery coating which consists of mycelium and conidia. In severe cases of infection the under sides also become similarly coated white (Plate I, Fig. I). The affected leaves become wrinkled and curled; turn pale, dry and fall off.

The diseased flowers, especially the unopened buds, become partly or wholly covered with a dense felt of fungal mycelium (Plate I, Fig. 2). The petals of infected flowers become badly discoloured; they often do not open but remain closed, as if glued together. The diseased stalks and the calyx become more or less red coloured; this red discolouration is more marked in some varieties than others. The infected stalks become twisted or wavy; the diseased calyx-tubes swollen, the swelling is either uniform or lop-sided. The top-most tender parts of the stem also become similarly diseased, swollen and red coloured.

Causal Fungus.—The disease is caused by *Oidium leucoconium* Desm. which is the conidial form of *Sphaerotheca pannosa* (Wallr.) Lev. The hyphae of the fungus are colourless and measure 3 to 10 *u* in width. From the parts of the hyphae in close contact with the host surface are developed extremely fine appendages which penetrate the cuticle and enter the epidermal cells; once inside the cells, these slender appendages swell out

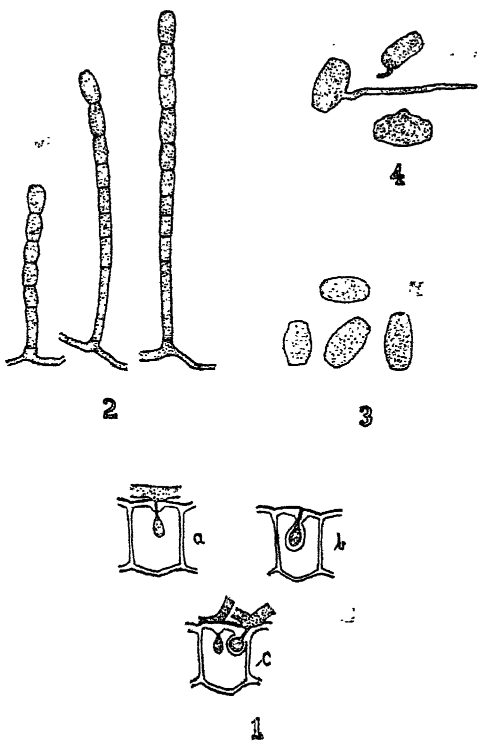


into unbranched pyriform to nearly globular haustoria (Plate II, Fig. I). The haustorium is often seen enclosed within a cellulose-sheath which appears to be a prolongation of the inner wall of the cell-wall. The haustoria are confined only to the epidermal cells. Usually only one haustorium is found in a cell, but occasionally two or even three may be seen in one cell.

The conidiophore is hyaline and unicellular (Plate II, Fig. 2). It greatly varies in size, measuring 20 to 68 *u* in length (average 47 *u*), and 7 to 10 *u* in width (average 8 *u*). It bears conidia in long chains, the oldest conidium being at the farthest end of the chain.

The conidia are hyaline, smooth and unicellular. They are usually barrel-shaped with both ends slightly rounded, but are also occasionally oblong (Plate II, Fig. 3). They are 18.7 to 32.3 *u* long (average 23.8 *u*), and 10.2 to 17.0 *u* wide (average 12.9 *u*). The conidia borne in chains on ends of conidiophores, fall of singly or in twos or threes. They germinate usually by one germ-tube, occasionally by two or even three (Plate II, Fig. 4).

Plate, 2.



Resistant and Susceptible Varieties.—Different varieties show varying degrees of susceptibility to powdery mildew. For example, in an infected part of a public garden, Edward, Mrs. Edward Mawley, Viscountess Enfield, Dean Hole and Black Prince were found to be most susceptible; J. Gilmore, Mrs. Mona Hunting, Mrs. Herbert Stevens and Madame Jules Grolez were less severely affected ; and C. K. Douglas, Ameliedegriel, Sumbriuel, La France and S. D. Verlchuron were very slightly diseased whereas Button rose, Cluster rose, W. R. Weddle, Betty Uprichard, Warrior, Marechal Niel and Marquise de quirohant were wholly resistant.

Control Measures.—Experiments to control powdery mildew on rose were first tried in this Province in 1930-31. Of the two fungicides tried, Bordeaux Mixture and Ammoniacal copper carbonate, only the first proved fairly efficacious against the disease. When the disease broke out again in an epidemic form in November, 1933, a number of fungicides was tried. A large nursery bed, which had only one variety of rose in it, viz, Edward, was divided into six equal-sized plots. Four of these plots were treated with either sulphur, Sulsol, Bouisol, or Bordeanx Mixture; these treatments were given after the mildewed parts of the plants had been pruned. The fifth plot was sprayed with Bordeaux mixture, but in this plot the diseased parts of plants were not removed. The sixth was left as control; the plants were neither pruned nor treated. Sulphur powder was dusted on the plants at the rate of ½ lb. per 100 sq. yards. Sulsol (5 lbs. in 100 gal. of water), Bouisol (3½ lbs. in 100 gal. of water) and Bordeaux Mixture (2-2-50) were sprayed at the rate of 2½ gallons per 100 sq. yards. Soft soap was added to all the liquid fungicides at the rate of 3 lbs. per 100 gallons of the solution.

The first spraying or dusting was on the 14th of December 1933, and was followed by a second spraying or dusting a month later as the newly developed tender shoots had also become infected. At the end of February when the disease had practically ceased to spread further marked differences were noticed in the different treated and control blocks. The plot dusted with sulphur was the least affected. The plots in which the diseased parts were pruned before the plants were sprayed with Sulsol, Bouisol and Bordeaux Mixture respectively, though not as good as the sulphur plot, were decidedly much superior to the control plot. The plot in which the plants were sprayed with Bordeaux Mixture without removing the diseased shoots were badly diseased, there being hardly any healthy plant in it.

In another experiment a large nursery bed of Edward variety of rose, was divided into four equal-sized plots. In two of these plots the plants were pruned so as to remove all the diseased parts. One of the plots in which the plants were pruned and one of the plots in which the plants were not pruned were dusted with sulphur, and the remaining two plots were left as controls. Dusting of sulphur was done at the rate of ½ lb. per 100 sq. yards. The treatment was given on the 8th of January 1934. Both the dusted plots remained completely free from the disease. The untreated control plot in which the diseased plants were pruned, was fairly free from the disease. But in the other untreated control plot the plants were very badly diseased.

A large bed of roses having several varieties growing side by side, such as Edward Mawley, Viscountess Enfield, Dean Hole, etc. etc., was badly diseased when the plants were in flower. The disease appeared rather late in the season, about the last week of January 1934. The plants without their diseased parts being pruned, were dusted with sulphur on the 25th. at the rate of ½ lb. per 100 sq. yards. The disease was at once brought under control, and the plants developed normal flowers.

These experiments show that the best method for controlling and preventing the disease is the timely application of sulphur at the rate of half a pound per 100 sq. yards. Ordinarily a single application of this fungicide keeps the disease under complete control; but in damp and shady places or in moist cold weather a second or even a third dusting may be necessary.

Explanation of Plates.

Plate I, Fig. I. A leafy shoot of rose infected with powdery mildew.
Plate I, Fig. 2. Unopened buds of rose infected with powdery mildew.
Plate II, Fig. I. (*a*) A haustorium in an epidermal cell;
(*b*) A haustorium in an epidermal cell enclosed within a cellulose-sheath;
(*c*) two haustoria in one epidermal cell.
Plate II, Fig. 2. Conidiophores bearing conidia in chains.
Plate II, Fig. 3. Conidia detached from conidiophore.
Plate II Fig. 4. Conidia germinating in water on a microslide.

ISOLATION OF WILT-RESISTANT TUR

By Ravi Shanker, L. Ag.,

(*Assistant to Second Economic Botanist, C. P.*)

Introduction.—*Tur* or pigeon pea (*Cajanus indicus*) is the most widely cultivated pulse in India. In this province it ranks high among the pulses, entering as it does, into the daily food of a considerable number of people. The outer integument of seed together with part of kernal which is known as *chuni* provide a valuable food for milch cattle. It being a leguminous crop possesses valuable property as a restorative crop adding nitrogen to the soil.

The importance of the crop can be realized from the fact that about 500,000 acres of land is directly devoted for its cultivation, and as a mixed crop with cotton or juar it covers an area of about 800,000 acres.[1] It is largely cultivated in the cotton tract of the province as it forms a very suitable restorative crop for cotton. As a pure crop it is largely grown in the lands which are considered too poor for cotton. In the northern districts it is grown on light or other undulating lands either pure or mixed with *juar* or sesamum.

The most serious diseases which affect this crop are wilt and frost. The latter is restricted to the north of the province where area under this crop is comparatively less than in the south. Frost generally occurs during or after Christmas week. The best remedial measure against it is to grow early maturing varieties like Tur E. B. 3 or *Aghnu tur* which being early varieties are ready for harvest before the usual occurence of frost. Wilt disease is common throughout the province and is more distructive in Berar and other southern districts. Every year a loss of about 5 to 20 percent of the crop is estimated on account of this disease and in some places in Berar a loss of over 50 per cent has been reported, specially in fields which are cropped with *tur* successively for two or more years.

The annual harvest of *tur* in this province reaches a total of about 142,285 tons and which valued at the moderate rate of 20 lbs. to a rupee comes approximately to Rs. 15,823,920. Taking the mortality of plants due to the wilt disease to the minimum figure of 5 p. c. the annual loss in the production of the crop in this province comes to Rs. 7,91,196,

The disease is caused by a parasitic fungus known as "*Fusarium vasinfectum* Atk." The disease is characterised by withering and drying of plants exactly as if it is suffering from drought even though there may be plenty of moisture in the soil. The spores of the disease remain in the soil and the infection occurs through the fine lateral roots which are penetrated by the hyphea. It grows inside the roots and chokes the xylem vessels whose function is to carry the water taken by the roots to the upper parts of plants; thus the water supply of the affected plants from their roots is stopped, they begin to droop and ultimately die (Butler, E. J.)[2]

The disease being soil borne direct treatment is not possible and hence only indirect methods have to be adopted. The chief remedial measures therefore are:—(1) rotation of crops, (2) growing wilt-resistant varieties. The former method is not found very satisfactory as certain amount of infection is always carried with seed. It is reported that when disinfected seed of *rahar* was grown in wilt free land at Pusa, 1.46 percent of infection was found in the crop (McRay and Shaw[4]). Therefore the second method i. e. growing wilt-resistant variety, is the most satisfactory way for evading the disease.

Breeding a disease resistant variety of a crop requires good deal of time and labour and it is further complicated by the fact that the disease resistant variety should also possess other desirable characters such as cropping power, time of maturity, etc. There are two methods of breeding disease resistant varieties (as Shaw)[4]: (1) isolation of all possible unit types from the local mixed crop of the tract and then testing their susceptibility to the disease. (2) selection of individual plants which withstand the disease in a disease infected land and testing their progenies for several generations. The first method has been followed in this case, as it was found more advantageous and was likely to produce early results.

Investigations.—The thirtysix unit types of C. P. turs isolated from the mixed crop of the province (Mahta, D. N. and Dave, B. B.[3]) were grown. The field selected for these experiments was under tur continuously for several years and was known to be infected with the wilt disease. In order to insure the maximum amount of infection in the land it was inoculaed every year with the culture of the disease about a week before sowing.

In 1931-32 seventy strains of the various C. P. types of tur were sown in single lines, After germination the crop was thinned out in

order to maintain equal number of plants in each line. Wilting of the plants due to the disease was first noticed during the year in the beginning of august and the diseased plants in each line were counted regularly at weekly intervals and the record of the mortality of plants was carefully kept for each culture. A vide variation in the death rates of plants due to the disease was noticed among the various cultures and it gave hopes of the possibility of isolating a wilt-resistant variety.

Two typical and healthy plants from each of these 70 cultures were selfed and the selfed seed was preserved for further work.

In 1932-33 the selfed seed from these 70 strains was again sown in single lines in the same field where these experiments were conducted during the previous year. In order to minimise the effect, as far as possible, of inequality in the intensity of the disease infection in that land, care was taken that the seed of a particular strain was not sown in the same place as that in the previous year. The record of the mortality of plants in each strain due to the disease was maintained as in the previous year. The observations are recorded in table, 1. During the year infection in cultures Nos. 31 and 38 was 32.6 and 8.82 percent respectively in others it varied from 50 to 90 p. c. After perusal of the record of the mortality of plants due to the disease in these various cultures during the previous years, 24 cultures were selected for further trial, the others were rejected as they showed more than 60 percent of infection in both the previous two years. Two typical and healthy plants from each of these 24 cultures were selfed and the selfed seed was preserved for future use.

In 1933-34 the selfed seed of these selected 24 cultures was grown in the same field where these experiments were conducted in the previous years and the record of the mortality of plants due to the disease was maintained as before. During the year Nos. 31 and 38 showed the least amount of infection, deaths in each of these two cultures was 33.3 and 25.9 percent respectively. In others the infection varied from 60 to 100 percent.

The results of the trials conducted during these three years revealed that Nos. 38 and 31 possess the greatest resistance to the disease among these strains. The average infection in Nos. 38 and 31 was 18.4 and 35.1 percent respectively ; in others it varied from 50 to 100 percent (Table 1).

TABLE 1

Percentage of wilt infected plants in the various tur types.

Culture number.	Percentage of the diseased plants,			
	1931-32	1932-33	1933-34	Average.
7	45.5	80.0	66.9	61.1
8	66.6	84.4	85.2	78 7
11	83.8	61.2	69.5	71.2
12	91.6	88.0	100.0	93.2
15	82.2	57.4	73.7	73.4
20	65.7	85.1	84.2	78.3
26	51.7	86.6	70.0	69.4
31	39.6	32.6	33.3	35.1
32	87.5	54.5	86.0	76.0
37	69.6	47.9	83.9	67.2
38	20.5	8.8	25.9	18.4
44	74.1	67.4	92.4	77.9
45	36.8	55.5	63.4	52,1
47	35.2	87.7	82.0	67.9
50	30.0	82.8	89.9	67.6
80	45.1	91.6	90.8	75.8
83	45.5	75.6	57.9	57.7
85	44.7	59.5	100.0	68.1
86	59.3	46.9	84.2	63.2
99	81.8	94.3	83.9	86.7
107	30.6	73.4	78.4	57.5
108	41.7	48.8	85.2	68.0
109	35.4	86.3	100.0	73.9
144	27.7	78.2	99.8	68.6

In order to ascertain further the resistance capacity of the two types Nos. 31 and 38, they were tested on a field scale. The selfed seed of both Nos. 31 and 38 was grown in long blocks alternating with those sown with E. B. 3 which was used in this case as a control. The area was infected with the culture of the disease a week before sowing. Each variety was repeated eight times and equal number of plants were maintained in each line. The record of the disease infection was maintained as described above. The casualties of plants due to the disease in Nos. 31 and 38 were found during the year 20.52 and 16.50 percent respectively. The statistical treatment of the data proves the significance of the results. The difference in the mortalities due to the wilt in cultures Nos. 31 and 38 is statistical significant; No. 38 gives a greater percentage of success than No. 31 (Table 2).

TABLE 2

Percentage of wilt infected plants in the improved varieties of tur.

Varieties.	Percentage infection.	mean number of diseased plants.	mean difference as compared against E. B. 3	Value of "t"	limits of probability.
No. 31	20.5	15.75	—40.25	10.93	0.01
No. 38	16.5	11.62	—43.38	12.50	0.01
E. B. 3	80.0	56.0	—	—	—

After isolation of the wilt resistent variety No. 38, attention was diverted towards testing its cropping power. For this yield test eight varieties viz. E. B 2, E. B. 3, E. B. 38, and the 5 wilt resistant Pusa types Nos. 41, 50, 51, 80, and 82 were grown in a latin square laid out in a piece of land which was known to be free from the disease. The size of each plot was 25 feet square. The results of the trial are recorded in Table 3. The statistical treatment of the figures of the trial of these eight varieties shows that E. B. 2, 3, and 38 are significantly higher yielders than any of the Pusa types. The observed difference between the yield of the local selections and those of each of the Pusa types is much greater than the critical value of difference which is 0.6208, (when P is 0.01). The observed difference between the yields of E. B. 3 and E. B. 38 is statistically insignificant and it is asserted from the data that No. 38 is as good an yielder as E. B. 3 (Table 3).

TABLE 3

Yield trial of the improved varieties of turs.

Varieties.	Average yield.	Mean yield difference from E. B. 3	Standard error.	Critical value of difference.
E. B. 2	10.151 lbs.	+1.01	0.23	0.6208 (P=0.01)
E. B. 3	9.14 "	—		
E. B. 38	9.27 "	+0.13		
P. 41	3.52 "	—5.62		
P. 50	2.94 "	—6.20		
P. 51	2.82 "	—6.32		
P. 80	3.92 "	—5.22		
P. 82	4.24 "	—4.90		

Description of E. B. 38.—It is a selection from C. P. type 9. Plant tall, robust; stem red, branching characteristic and sparce; branches erect, rise high up on the mainstem, usually from the seventh node, about 50 c. m. above the ground level, at an angle of about 55 degree. Leaves deep green; pedicle and calyx green, a faintly streaked; flower yellow, back of standard viened with red. Pod blotched with maroon. Seed attractive brown, medium size. Medium in flowering and early in maturity. It is ready for harvest in December or January. On account of its early maturing quality it can escape from the ravages of frost in the northern parts of the province. It is under trial at present in Berar, Chhatisgrah and the plateau districts and has been favourably reported. On the College farm at Nagpur, it was grown on an area of about 8 acres and have yielded about 500 lbs. per acre.

The wilt resistant, Pusa types though strongly wilt resistant, are not suitable for the conditions available in this province. They are low yielders and mature very late, somewhere in March or April.

Summary.—The isolated C. P. types of *tur* have been tested for wilt resistance in a wilt infected area continuously for four years. Of these E. B.38 a starin from C. P. type 9 is found to possess the greatest resistance to the disease. Cropping power of E. B.38 is compared against the standard varieties E. B. 2 and E. B. 3, E. B. 38 is found almost as good an yielder as any of the latter two. The wilt resistant Pusa types are not found suitable for the conditions of this province.

E. B. 38 is recommended for tracts where wilt is a great menace for the successful production of tur and for the wilt free tracts E. B. 3 will be the most suitable.

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DETERMINATION OF MANGANESE IN SOILS.

By Prof. V. Subrahmanyan, D. Sc., F. I. C.,

Indian Institute of Science, Bangalore.

During recent years, a number of methods have been proposed for the estimation of manganese in soils. Most of them consist of three steps.—(1) extraction from soil; (2) conversion into one of the better known forms, generally the permanganate and (3) the quantitative estimation of the final products. The major part of the manganese of soils being either in the form of insoluble manganous salts or higher oxides, chiefly manganese dioxide, the extraction is best carried out after treatment with suitable reducing agents such as zinc dust, reduced iron, ferrous sulphate, oxalic acid or hydrogen peroxide in media containing sulphuric or hydrochloric acid. After extraction, the manganese in solution (which will be exclusively in the mangenous condition) is oxidised to either manganese dioxide or permanganate, perferably the latter, by one of the more powerful oxidising agents-persulphate, periodate, perchlorate or bismuthate. Among these, the bismuthate is perhaps the most rapid and, at the same time, the most convenient to handle. The estimation of the resulting permanganate is carried out by one of the usual methods, preferably by absorption in excess of ferrous ammonium sulphate followed by back-titration against standard permanganate.

The various methods that have been so far proposed differ from each other in regard to efficiency of extraction. The subsequent oxidation does not also proceed quantitatively unless the conditions are properly standardised. There is also interference from the halides which may be present either in the soil or in the reagents employed. In view of these defects a systematic enquiry was undertaken with the object of evolving a rapid and quantitative method for the estimation of manganese in soil.

Extraction.—Preliminary experiments with known quantities of manganese dioxide, either as such or after addition to soil, showed that while most of the reagents were more or less efficient in bringing manganese dioxide alone into solution, they were not so effective when it was admixed with soil. The results obtained for the soil itself were generally variable, so that it was not possible to decide as to which of the reagents previously mentioned was the most efficient. Some new reagents were accordingly tried and it was found that alkali sulphite in acid medium was not only more rapid but also more efficient than any of the

other reagents so far tried. The final estimates obtained with soil were also higher than those secured by other methods.

Oxidation to Permanganate.—Attempts were first made to convert the manganese in solution to manganese dioxide which could be subsequently estimated iodometrically. Among the various reagents tried for this purpose, hydrogen peroxide in alkaline medium was the most efficient. The reaction was almost instantantaneous. The subsequent estimation of the precipitated manganese dioxide was also very rapid, but, unfortunately, the method is not suitable for soil extracts, which invariably contain iron. The resulting ferric oxide also releases iodine from potassium iodide so that exaggerated estimates of manganese are obtained. In view of this defect, the oxidation was carried to the permanganate stage in subsequent trials.

As already mentioned, treatment with bismuthate in acid medium is the most elegant method of converting manganous salts into permanganate. The reducing inorganic substances, if any, as also such small quantities of organic matter as may have passed into the extract are readily oxidised by the bismuthate.

Elimination of Errors due to halides.—It has been shown by Subrahmanyan, Narayanayya and Bhagvat (2. *Indian Inst. Sci.*, 1934, *17A*, *197*) that mercury salts prevent the formation of free halogen from halides even in presence of hot, sulphurochromic acid mixture. Some experiments were accordingly carried out, adding known quantities of sodium chloride to manganous salts treated with mercuric oxide to determine whether any chlorine was formed on addition of bismuthate. It was found that there was not a trace of chlorine even after prolonged boiling.

Blank for Bismuthate.—Another source of error which many workers seem to have overlooked is the blank for bismuthate itself. The error is generally positive and is proportional to the quantity of bismuthate added. The correction to be applied is, however, quite small being of the order of about O.1 c. c. N/10 for each gram of the reagent.

The procedure developed by Harihara Iyer and Rajagopalan in these laboratories may be outlined as follows.—The soil (10-15 g.) is treated with pure sodium sulphite (chloride-free; 5 g.) and dilute sulphuric acid (4N; 100 c. c.) If the sulphite has been partly oxidised to sulphate, a larger quantity than 5 g. will be required. It will be desirable therefore

to check the purity from time to time. The mixture is well shaken and raised to boil. The boiling can be done in the open laboratory. The major part of the sulphite is taken up in the reduction, so that the quantity of sulphur dioxide actually given off is very small. After a few minutes, the entire quantity of manganese is brought into solution and the unused sulphur dioxide driven off. The suspension is then filtered through a Buchner and the clear filtrate transferred to a conical flask (capacity about 250 c. c.) It is then treated with mercuric oxide (red or yellow variety, 2-3 g.) and sodium bismuthate, the latter being added in small quantities at a time. Suspension is momentarily raised to boil, fresh quantities of bismuthate being added until the colour of permanganate is permanently established. It is then filtered through a Gooch or Jena glass filter, the filtrate being received in acidified, ferrous ammonium sulphate (N/25). The unused portion of the latter is then titrated against standard permanganate (N/25) in the usual way.

A preliminary experiment carried out with known quantities of bismuthate alone will give an idea of the error due to that reagent. As already explained, the error is very small and the necessary correction can be easily applied by adding known quantities of bismuthate for each experiment.

Advantages of the modified procedure.—(1) The extraction is rapid and quantitative. (2) The use of excess of reducing agent and conseqent wastage of the expensive bismuthate is avoided. (3) The error due to halides is obviated.

Applications.—The methods has been successfully applied not only for estimation of total manganese but also for studying the transformations of manganese attendant on the decomposition of organic matter in the soil. It is also capable of extension to a number of other enquiries relating to the role of manganese in plant nutrition.

Extracts

COMBATING INSECT PESTS*

BY M. AFZAL HUSSAIN, M. SC., (PUNJAB), M. A. (CANTAB.)

Crop production is a very keen contest between nature and man. A farmer runs a race with soil, climate and enemies of crops, and it is very rarely that an Indian farmer wins the race. It may be claimed that, with efforts, he can mould the soil for his purpose, and be independent of heaven's mercy for water when facilities for irrigation exist, but climate is beyond his control and the gods of seasons are rarely kind to him. He lives perpetually in terror of dust storm, drought, excessive and untimely rain, hail-storm, frost and so on, and in addition to these, diseases and pests threaten his crops. The enemies of crops are indeed numerous and range from the ultra-microscopic viruses, which pass through the finest filter, to elephants. The most numerous and the most tenacious of all these are the insects which cause our farmers untold losses

Nature has endowed these animals of small size an organization most suited for rapid increase in numbers and there is hardly any matter of animal or plant origin living dead or decaying, which does not provide food for some insects, and there is hardly a habitat in which insects are not found. Some insects feel even on opium and there is a fly the larvae of which live in pools of kerosene oil.

Such creatures man has also helped to flourish. Man has cleared vast tracts of natural vegetation and brought under irrigation extensive arid regions, and on the land thus made fit for his use, he grows his crops, or in other words crowds together an enormous number of plants of the same type. He thus provides certain insects with immense quantities of easily available nutritious food.

Besides, man conserves animal and human food of every description, to this insects have free access, and they find conditions most suitable for their rapid increase. Near human habitation accumulate immense heaps of refuse, consisting of decaying organic matter, which provides certain insects with abundant food. Man has introduced plants of one country to another and with these he has brought in insect pests.

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* Agricultural and Live Stock in India Vol. VI, 1936.

India has given to the world a number of such insects and the compliment has been returned in the form of San Jose Scale, Woolly Aphis and Potato Tuber moth, to mention but a few. With his merchandise man has taken insects from one country to another and these enemies of man have thus crossed unsurmountable barriers with effort. Quick means of transport railways, motor-cars, steam-ships and now aeroplanes, all help in the spread of insect pests. Under natural conditions insects had numerous enemies, which checks their rapid increase; unfortunately through his lack of foresight man has destroyed the abodes and actually killed off these maintainers of balance in nature. Numerous birds and reptiles and other animals, which fed mainly on insects, man has reduced to a condition of impotency. In short, man's system of crop-production cultivation, irrigation, growing, harvesting and storing crops, disposal of crop remnants and refuse, has produced conditions which enable certain insects to escape the rigours of climate and attacks of their enemies and find abundant supply of easily available food. No animal has interfered with nature to the extent that man has done and in doing so he has helped his most virile competitors-the insects, to multiply unchecked. The punishment imposed by nature upon man for this interference is also very heavy. It has been estimated that in the United States of America, in spite of her most advanced pest control organization, insects cause a loss of 2 billion dollors annually. Fletcher estimates that in India the annual loss to sugarcane, from borers alone, is not less than Rs. 200 millions per year. During 1905 it was through the ravages of a single insect-the spotted bollworm of cotton-that the Punjab cotton growers suffered a loss which has been estimated at 5 crores of rupees. San Jose Scale is responsible for the destruction of thousands of fruit trees in Kashmir and the fate of this industry depends directly on the effort put in to check this pest. It has been stated that, at a very conservative estimate, the Indian farmers and fruit-growers pay their insect conquerors a tribute which is not less than Rs. 1,95,00,00,000 a year. As our population increases and our needs grow greater, we come more and more in conflict with insects. and therefore the fight is becoming keener and more intensified every day, and at every stage insects defy man's efforts for mastery over the resources of the globe. There is nothing to show that man's victory over insects is either near, or sure.

Since pre-historic times man has waged war against insects and has evolved varied methods to save this crops and crop-products from depredation by these foes. Some of these methods in their natural

simplicity appear most crude, while others based on the highest scientific knowledge and mechanical skill are most ingenious.

The simplest and natural method of " hand-picking ", which monkies and human beings employ to get at the body-louse, has survived upto the present day because of its efficacy. A number on our important pests, for example, the Red Pumpkin bettle and the Egg-plant Lady-bird beetle can be effectively controlled, over small areas, by this method. Where childish enthusiasm can be directed into useful channels, or the cultivators have spare time, this simple method may yield results of value even over larger areas. Sugarcane TopBorermoths and caterpillars of Lemon Butterfly have been successfully handpicked. What is captured may be crushed. but a more elegant procedure is to drop the catch into a receptacle-for example an old cigarette tin suitably stringed-containing water with a layer of kerosene oil

Some insects when disturbed fall down from a tree and may be collected in sheets or umbrellas. Some bettle pests can be effectively controlled by this method.

A number of our serious crops pests lay eggs in clusters, and it is possible to crush such egg clusters *in situ*, or to hand-collect and destroy them. Such insects as the Sugarcane Pyrilla, Sugarcane Moth Borer Hairy Caterpillars often yield to this treatment. Collection of eggs is one of the measures of locust control and during locust invasions enormous quantities of egg masses have been dug out of the soil and destroyed.

Among aids to hand destruction of pests mention may be made of such simple contrivances as the fly-flappers, insect hand-nets sticky rackets etc. In the Punjab hand-nets have been very successfully used against Sugarcane Pyrilla. In the hands of an army of boy scouts this simple implement may work wonders. An elaboration of the hand-net is the " field-bag ", which is effective against grass-hoppers. To the same category belong the hopper-dozers.

One method of dealing with insects boring into stems of fruit trees is to hook them out by means of metal wires with hooked or barbed ends.

Trapping bas been used offectivly againsts insects. The simplest form of trap is a pit, trench or ditch. Insects moving in large swarms

readily fall into ditches dug in their path. When in these ditches they can be earthed over, This method has been extensively employed in locust control and, in conjunction with barriers has proved most effective. Locust hoppers may even be driven to a trench made for their reception.

Lures are often used to entice insects to their doom. Entomologists have taken advantage of the fascination which light exercises over certain insect, and have evolved light-traps varying from a lamp placed over a vat containing kerosenized water to elaborate automatic electric appliances for attracting and capturing insects. The most recent of these is the violet ray apparatus. Light traps have given excellent results, against Amsacta moths, Ber beetles (Adoretus nitidus) and Nephotettix.

It is presumed that insects are guided towards their food, most probably, by some sense akin to our smell, and this is the sense which most often brings the sexes together. If agents of these attractions can be discovered, it should be possible to devise effective traps for capturing most insect pests. Insects' response to certain chemicals is well-known. Sweetened baits are used to capture flies, ants, cockroaches, etc., and sweetened beer is used for house crickets and moths, and other chemical traps have also been tried. The males of the Mediterranean Fruit Flies are attractd strongly towards kerosene oil and those of our Peach Fly towards enginol. Unfortunately, the females are not influenced in the least by these chemicals.

Heat is an effective insecticidal agency. No insect can long survive an exposure to a temperature of 150°F., and most of them succumb to 130°F., if exposed to it for a few hours. In India, where bountiful nature has bestowed us with a free source of strong radiant energy, sun-heating is an economical and effective measure against insect pests. Such material as weevilled grain, cotton woollen material, books, furniture, etc., can be sunheated. It is also possible to raise the temperature of a room sufficiently high to destroy insect life. Modern flour mills, grain elevators, ships, glass house, etc., are provided with permanent installation for heating them to the required temperature. There are machines available which heat to a temperature lethal for insects, infested grain, or seed, which is run through. In Egypt such heaters are used extensively in campaigns against the Pink bollworm of cotton, the hibernating caterpillars, which are responsible for the carry over of the pest, are thus destroyed. The same measure has been proposed for the United Provinces. Whether heated in a machine or by exposure to sun, this pest can be checked by

systematic and organized campaign of heat treatment of all seed, prior to the emergence of moths.

Heat cannot be employed in all cases. Rice exposed to a temperature of 130°F., is spoiled because the enamel of the grain cracks, similarly tobacco deteriorates on exposure to high temperature. Therefore, low temperature is employed in these cases. Cold reduces insect activity and there is practically no insect damage if the temperature is below 40°F.

Fire is employed to destory insects. Locust hoppers congregating in thick swarms over dry bushes may be burnt to death. Flame throwers although expensive to work, have been used extensively in locust campaigns. If a material is badly infested and its destruction will save a much greater damage, then fire is a valuable "purifier", hence the recommendation "cut" and burn". All refuse collected from stores, mills and factories suspected of harbouring insect pests, should be consigned to fire such crop remnants as contain hibernating stages of insect pests should be pulled out and used as fuel. Borers of sugarcane, rice, maize and jowar will be greatly reduced, if stubbles of these crops are collected and burut before the emergence of moths after winter. Burning cotton stick before the new crop is sown will eliminate many of the cotton pests,

Poisons—man's favoured weapon against his enemies—came into use quite early in fighting insects. Some poisons act when taken internally (stomach poisons), and the commonest and most efficacious of these are the arsenicals, These are poisonous to man and domesticated animals and for this reason there is considerable, although unjustifiable prejudice against them. In 1923 the U. S. A, used 45 million pounds of arsenicals without any serious mishap. Recently, however, some flourine compounds of sodium and calcium, and other chemicals, have been discovered which are distasteful to poultry and not so poisonous to cattle and man.

The stomach poisons are applied to the food of the pest. Either a thin film of poison is spread over the surface of the plant, which the pest devours, or it is mixed with a material which the pest would eat readily (poison-baits). The poison bait of bran, or other similar material, is the most efficacious method of dealing with locusts and grasshoppers, cutworms and house crickets, and insects with similar habits.

A large number of serious plant pests puncture the tissues and such plant juice. Such insects cannot be killed by stomach poisons, and

insecticides have to be used which cause their death when coming in in contact with their bodies (contact-poison). Soaps, emulsions of mineral oils, sulphur compounds, naphthalene compound, rosin compound, etc., have such action.

A number of plant products of excellent insecticidal value are available; of these some act as stomach-poisons, e. g., hellebore, while others as contact-poisons, such as nicotine and pyrethrum, and still others act as both, e. g., derris.

Insecticides whether in the form of dust, suspension, emulsion, or solution must be applied evenly, quickly, and economically. Very rapid advances have been made to evolve suitable spraying and dusting machinery. From simple hand syringes and dust shakers we have advanced to elaborate power sprayers and duster. Certain orchardists have stationery power pumps with permanent pipes laid among rows of of trees, and on the other extreme we have aeroplane dusting and spraying of crops and forests. How efficacious aeroplanes are may be judged from the fact that an acre can be sprayed in seven seconds. Locust are poisoned by dusting their food plants by means of aeroplanes and attempts are also being made to deal with the flying swarms from the air. In India no aeroplane dusting or spraying has been tried so far.

Most of the insecticicides, and spraying and dusting appliances are imported into India, and very often the prices make their use prohibitive. The future development of the insecticidal method of insect control depends directly on the availability of cheap and suitable insecticides and dusting and spraying appliances.

Poison gasses have been employed very commonly against insects attacking stored grains and stored products, and against other household pests. The fumigants most commonly used are hydrocyanic acid gas and carbon bisulphide, but sulphur dioxide, carbon monoxide and dioxide, carbon tetrachloride, para-dichlorobenzine, and even pyrethrum powder and tobacco extracts are also employed. The latest development of this method is fumigation under vacuum, where the material to be fumigated is placed in a special container the air of which is withdrawn, and the fumigant introduced. This facilitates penetration and reduces the time of exposure. Fumigation, with hydrocyanic acid gas, of living plants in green houses or in special boxes and even under "tents" is an effective method of pest control. The Indian Central Cotton Committee

fumigate all consignments of American cotton to safeguard against the entry of the notorious Boll Weevil of cotton, and all living plants imported into India have to be similarly treated at the port of entry to safeguard against foreign pests.

The ancient practice of storing grain with a small quantity of amalgum of mercury with oil or ashes has a scientific basis. It has been found that in the presence of mercury vapour insect eggs do not hatch.

To fight soil-insects, insecticides in the from of dust, liquid and gases are employed. Dusts may be sprinkled over or dug in, and liquids and vapours are forced in. Soil injectors of different types have been evolved leading from hand injectors to traction injectors.

The most interesting development of chemical warfare against insects is through injections of chemicals into the tissues of plants. Barium chloride, aluminium sulphate, pyridine in very weak solutions have given good results against Woolly Aphis of apples. Small pieces of potassium cyanide introduced into the trunk of trees destroy scale insects and other sucking insects, but the process is not without risk. Trunk borers of trees may be treated by plugging the burrow with cotton wool soaked in chloreform-benzine mixture or similar other material.

Even more ingenious than the above is the development of immunity or resistance among plants through soil treatment. Mosquito Blight of tea has been effectively checked by applying phosphatic manures. This field of attack presents immense possibilities. It is reasonable to suppose that soil conditions may so influence a plant as to develop immunity or resistance against certain pests.

Insects have also been destroyed through ethereal vibrations. The Cigar beetles have been destroyed by exposing boxes of cigars to Roentgen rays, and radio waves have been used for the control of plant pests. It is expected that ultrasonic waves will prove of great value in insect control.

Valuble crops may be protected by enclosing them within trenches or metal sheet barriers. Invading bands of locust hoppers and similar other swarming insects are thus kept away. Valuble seed beds may be protected by wire-netting and valuable fruits may be enclosed in paper bags, or bags of netting. Wire gauze of suitable meshes wrapped round

the stem of a fruit tree is a good protection against attacks of borers, such as the fig-teee borer.

A number of insects lay their eggs in the soil and their young ones on hatching out crawl up the trunks of trees to reach the soft shoots or flower heads. These insects may be stopped in their ascent by the use of barriers applied to the trunk of trees. Bands of smooth glazed paper smooth oil cloth tin sheets, coal tar and other sticky materials form effective barriers. Band of fluffy cottons are particularly efficacious against Monophlebus nymphs that crawl up the tree from the soil. A ring of sticky substance, heavy oil or coal tar painted on the soil does not permit insects to reach valuable plants, coal tar and gas refuse are good repellants to safeguard against white-ant attacks. Tapes soaked in corrosive sublimate are not crossed over by ants.

Insects, although the favoured of nature, are an important source of food supply for some animals and are subject to attacks of organisms causing disease and death. And just as is the case with human beings, overcrowding in a locality encourage epidemics. Whenever an insect appears in enormous numbers its enemies also increase. Bacteria, fungi, protozoa, and parasitic worms-the chief causal agents in human disease also parasitize insects. Quite often severe on sloughts of insect pasts are wiped out by these organisms. Of the animals with back-bone, some fish, all frogs and toads, many lizards and snakes, numerous birds, hedgehogs, shrews, bats, lemurs, monkeys and many other mammals mainly subsist on insects. Larvicidal fish, whose favourite food are mosquito larvae, have secured a place of honour among measures of malarial control. Birds, because insects form the staple diet of a large number of them, are farmers' best allies. It has been truly said that without his beautiful feathered friends, man will find it difficult to hold his own against insects. Unfortunately it is this groups of beneficial animals which man has reduced in numbers to his great misfortune. For their useful work in dealing with the locusts the starlings have received government protection. Bird protection and encouragement is of great value to the farmer. It must, however, be remembered that in absence of insects even the insectivorous birds feed on grain and fruit, and it is, therefore, necessary to watch bird increase and activity with great care. The value of the study of birds and their food to an agricultural country cannot be over-emphasised. Combining fruit-growing with poultry-farming has evident advantages. In a limited area a pen of

poultry would clear off grass hoppers within a short time, and will make a short work of other insects found on the surface of the soil or just below it. Even insect eating bats have their value.

The chief enemies of insects are however, those of their own kith and kin. It has been estimated that in a given area 25 to 30 per cent of the insects present feed on other insects. Were it not for this army of beneficial insects, the harmful insects would have obtained a sure victory over mankind. The commonst examples are the Lady-bird beetles, Lace-wing flies, Hover flies, Dragon flies, Predacious beetles, Preying mantids, flies and wasps and members of other groups. These among insects devour Green-fllies, White-flies, Scale insects and other insects. There is yet another section of this useful army which consists of parasites-small wasps, flies and members of certain other groups. They lay their eggs on or in the bodies of insects and their young ones live on the tissues of the victim and kill it. All the stages from egg to adult may be parasitised.

Entomologists have attempted to array this army of beneficial insects on the side of man. In some cases wonderful success has been achieved. One single instance will be given. The Cottony cushion scale of citrus was introduced from Australia into California in 1868. By 1890 it had killed thousands of trees and the citrus industry was in danger of being completely wiped off. From Australia 500 of the Lady-bird beetle predators of the scale were introduced and distributed among the fruit-growers. Within a year and a half the beetles had multiplied in sufficient numbers to check scale.

Biological control of insect pests has givin best results against introduced pests. In India, where most of the pests are indigenous, an equilibrium has been set up between the pest and its enemies, therefore without special efforts it is not possible to give a predator or a parasite a chance of winning the battle. There is however, a great need for large-scale, intensive investigation to determine the possibility of biological control of insect pests.

For India with her low yield of crops, and poverty-striken illiterate peasantry, the cheapest and simplest methods of insect control are the best, and prevention very often is better than cure. Most effective results can be obtained by carrylng out farm operations intelligently. It is estimated that 95 percent of the insects pass some portion of their

life-cycle in the soil. Tillage operations expose insects in the soil to the severity of climatic conditions-blazing heat, heavy frost or desiccation and to their enemies-predators and parasites. very few insects can survive in a field which has been ploughed up often enough. Soil preparation is thus of great importance in insect control. Irrigation is also an effective method in pest control. White-ant attack on wheat or sugarcane can be checked by watering, and flooding destroys many other pests. Manuring to produce vigorous and quick growth, and early maturity also help in decreasing losses caused by insects. Soil conditions very often determine the degree of resistance that a plant develops against a pest, and soil conditions depend on tillage, irrigation, drainage, manuring etc. Altering time of sowing to escape insect attack also has great possibilities. In places where mole crickets injure wheat, delayed sowing is an effective remedy.

A proper crop rotation is useful in combating insect pests. It has been seen that cotton sown after gram is likely to be damaged by Laphygma, which feeds on gram and can also feed on cotton.

Cleanliness on the farm or in an orchard is of utmost value in insect control. Accumulation of rubbish, fallen leaves, old vines, dry twigs stones, etc., provide shelter to some insects during the intense heat of summer and the severe cold of winter It is in such situation that insects which are active at dusk and at night, lie concealed during the day, and day-insects spend their night. Remnants of crops which are left in the field after a crop has been harvested provide food to some and shelter to many. Borers of rice, maize, jowar and sugarcane over-winter in the stubbles that are left in the fields. Weeds that grow among crops and fruit trees often provide food and shelter to insect pests. Sprouting crop remnants or volunteer plants supply food to insects at a critical stage of their annual cycle when their main food supply is not available. To control your insect foes destroy their shelter and cut off their food supply particularly at the most critical time of their seasonal cycle. Very often the most serious pests of crops are very specific in their choice. Spotted bollworm of cotton would confine itself to the Malvacious plants—the family to which cotton, common vegetable bhindi (ladies finger) and common garden plant Althea rosea belong. Top Borer of sugarcane has only sarkhanda as its chief alternative food plant. Red Pumpkin beetles do not feed on any plant outside the Cucurbits.

In some cases the alternative food plant is used as a " trap crop", a

crop which attracts the pest. This crop is grown to attract the pest to itself and when the pest has concentrated on it, the crop with the pest is, destroyed, i. e., cut and fed to cattle or ploughed in or burnt.

Domestication leads to decrease in the natural resistance of plants and animals. The more highly domesticated or improved a variety, the more severely it is likely to be attacked. There are, however, some varieties, which to a certain degree, combine resistance to pest attack with other useful qualities. The possibility of evolving such varieties has been demonstrated. A cotton which is Jassid-resistant has been produced and there are varities of Coimbatore sugarcane which are partially resistant to Pyrilla and Top-borers. It is known that apples grafted on the root-stock of Northern Spy and Winter Majetin develop rssistance against Woolly Aphis. It is very essential that when new varieties have been evolved their behaviour towards the commoner pests is carefully studied under varying conditions. Moreover, it is very important that the real basis of such immunity is scientifically investigated, so that we are able to build up a science of plant resistance. Very often a very small foctor, which may be considered of no consequence otherwise, such as slightly increased hairiness, a little toughness of the cuticle, a slight change in the acidity of the cellsap, a more vigorous growth at a particular stage, a particular habitat bringing about alteration in the micro-climate for the insects, may have far-reaching benefits.

It must, however, be remembered that there does not exist any plant that completely defies insect attack, and it is not likely that man will ever be able to produce a varity of any of his domesticated plants which will possess complete immunity, from all insects, for all times. There will be a continual race between our defensive efforts and insect attacks. Whoever can make rapid progress is sure to win.

This very brief and cursory review of the measures, which man has evolved to combat insect pests, shows that all the elements of human warfare are reflected in our attempts to fight insects. From hand-to-hand fight we have advanced to poisonous gases and attacks from the air. We are using electricity and are looking forward to death waves. There are, however, a few aspects in which there are tremendous differences. Our internecine wars we fight by means of a thoroughly trained and organized force. Most nations have enormous standing armies, kept at high efficiency and at all times fully prepared for action. In some countries there is conscription and every able-bodied man is trained to

fight. To combat insects we have no trained army and every cultivator without knowledge and training is expected to fight his battles by himself. Further, human wars are carried out with utmost abandon and the question of expense, although fundamental, is often relegated to the distant background. Nations may indulge in the luxury of wars on borrowed money. On the other hand when dealing with pests of crops, the question of first importance is that of expenditure, which is to be carefully considered in relation to the advantages gained and the measures to be adopted must necessarily be most economical. If it does not pay to kill an insect pest, it is not killed. No army can fight its battle to a successful issue, unless scientific research has provided it with weapons superior to that of its foes end through regular practice of war-craft it has not reached a high standard of efficiency, and unless it knows through its spies and through field reconnaissance, all about its enemies. Even then, the success is doubtful unless the entire resources of a nation human, animal and material—are placed at the disposal of the army. Surely when fighting insects—our most terrible foes—we must be armed with a full and detailed knowledge of their habits, behaviour. weaknesses, and disseminate this knowledge among the entire community to create a communal feeling against insects and prepare every man and woman, boy and girl, for this most noble of wars. In European countries training for defence against poisonous gas attack is being taught to the civil population; then has not the time arrived when the entire population should be acquainted with the methods of defence against our bitterest foes—the insects constantly present and always at war with us, inflicting us with foul diseases, causing us terrible loss in life, food and property? Thus there is a growing need for more and more research in methods of combating insects: and public instructions in warfare against insects.

Without organization insect control is impossible. A solitary individual, who spends money and energy on insect control wastes his resources, if his neighbours do not undertake such measures. Therefore, co-operation amongst the farmers is absolutely essential for insect control. To obtain the necessary co-operation and concerted action pest control organizations are essential. Legislation is the basis of organization. We must have laws to safeguard the carriage of pests from one locality to another. Some years ago in Madras a Pest Act was introduced and recently the Kashmir Durbar has legislated against San Jose Scale. It is true that all plant material imported into India is fumigated at the port of entry, but there is no check to the introduction of pest over the land routes and the pest laws are absent in most parts of the country.

Our country is far behind other countries in the development of pest control measures, and yet we have to compete with those countries in the world market. Our crop yields are low and in most cases the lowest in the world; we can no longer ignore the waste that is going on perpetually. Even 10 per cent of the Rs.1,95,00,00,000 that we allow insects to take from us, if saved and spent on rural reconstruction, will make India the land of peace and plenty.

SCIENCE IN THE SERVICE OF INDIAN AGRICULTURE*

The material results of scientific discoveries have, as elsewhere in the world, greatly benefited rural India and her agriculture. Better transport, better illumination, the rural electric supply, the telegraph and the wireless are all tending to raise the standard of comfort in the village. An even greater service is the application of the scientific method in the solution of the problems of agriculture which is largely an art and perhaps primarily a business. The conscious application of the scientific method is barely a century old but an immense amount of agricultural lore, gained as the result of experience, has accumulated which is both important and deserves to be scientifically interpreted. In India the first attempts at improving agriculture took the form of the opening of model farms for copying the methods in vogue in advanced countries. The appointment of American cotton growing experts, the importing of agricultural machinery including steam ploughs and the opening of model farms in Madras, Bengal and the U. P. belong to this phase. The next landmark is the report of the Famine Commission of 1880 and its successor of 1901 to which we own not only the development of irrigation, communications, rural credit, etc,, but also what eventually became the Provincial Departments of Agriculture. The visit of Dr. Voelcker and his most valuable report followed, as likewise successively the appintment of individual experts like Mr. Mollison, Dr. Leather, Dr. Barber, Dr. Butler. In 1904 Lord Curzon's Government made the next great advance which resulted in the creation of the Imperial Department of Agriculture, the opening of the Pusa Research Institute and the starting of properly equipped scientific Departments of Agriculture in the Provinces. Steady progress has followed and thanks to the wise and far-reaching recommendation of the Royal Commission on

* Summary of a lecture delivered by Sir Bryce C. Burt, at the Twenty-third Annual Meeting of the Indian Science Congress, Indore, on 3rd January. 1936, From "Current Science".

Agriculture, research can now be organised and financed with a precision previously unknown. With the Universities and kindred institutions co-operating with Agricultural departments the stage has now been set for a great advance in rural uplift.

With this somewhat familiar historical background we may now describe the contributions of the different sciences to the improvement of Indian agriculture using the term however in its narrower sense of mere crop production. This improvement in crop production has been along three directions, *viz.*, the improvement of the plant, its better nutrition and better protection against pests and diseases. More progress has been made in plant improvement than in improved plant nutrition in India for reasons partly economic and partly technical. The rapid advances in the science of genetics and its application to plant breeding has naturally led to much attention being paid to the improvement of the staple crops of the country, As a result, the area under improved wheats alone is well over 16 million acres, to take the case of a most important crop. Wheat indeed was one of the first crops to be studied, the names of the Howards, of Milne and of Evans being associated with the important work. The varities originated are all of high merit, one of them Pusa 12 having given double the yield of the local, over a seven-year period of of trial. All are also of high milling value and Pusa 12 combines with high yield, earliness, hardiness and good milling and baking quality. The Pusa improved tobacco is a cross between the Adcock and the Pusa 28 and combines the excellence for cigarette making with the valuable agricultural features of the local parent; the improved linseed of Pusa combines the root system and the agricultural habit of one type with the high oil contents of another and the types of Cajanus indicus evolved in Pusa are largely resistant to the wilt disease.

The work on sugarcane improvement at the Coimbatore Research Station has resulted in the production of highly satisfactory crosses between the wild cane and noble or tropical cane, eminently suitable for cultivation in Northern India where they now occupy some 60% of the total cane area of India. In the improvement of the cotton crop tests for the spining quality of the various strains evolved by plant breeders are systematically carried out at the Cotton Technological Laboratory of the Indian Central Committee, so that improved cottons undergo a rigid test on this important requirement of quality before they are pronounced as really improved strains. In this particular aspect of cotton improvement work, India can be said to be ahead of other cotton growing count-

ries and our Technological Laboratory is in many ways a unique institution. The result of all this work on cotton improvement is that quite 4 million acres are now under these improved varieties and that but for this development India will be importing foreign cotton to the value of some 7 crores of rupees.

In respect of better plant nutrition the second line of improvement work has somewhat lagged behind. Numerous experiments have brought out however the great dificiency of nitrogen in India soils, the need for organic manures, of aeration and of drainage. All of these have been emphasised and composts and green manures studied and recommended. Work on soil colloids, on the laterite soils of Eastern Bengal, on rice and sugarcane soils in the Bombay, Deccan and the C. P. is in progress as well as a comprehensive scheme for the study of dryfarming methods. Problems of excess water, of water logging, alkali trouble and kindered matters relating to irrigation are also receiving attention. In regard to artificial mauures they have been found to be economic under certain circumstances and India now uses not only the whole of her local production of 13,000 tons of ammonium sulphate, but also had a net import of 38,000 tons in the year 1934-35. Field experiments covering manurial and other problems have become more precise in lay out and interpretation, thanks to the aid of mathematical technique furnished by the Research Council.

The third division in crop improvement relates to the avoidance or reduction of losses caused by plant pests and diseases. These levy a heavy toll on agricultural wealth and there is need for all the help science can give. Taking sugarcane for instance, these pests comprise moth borers, the Hispabeetle, the cane hopper, mealy bugs, white fly and termites. By suitable varieties, cultivation methods and dusting with insecticides some of these can be controlled and biological methods also hold out promise. The pink boll-worm of cotton and the spotted holl-worm cause large losses annually, but simple methods of control have been devised and demonstrated, viz., the heating of the seed in the first case and the removal of the cotton stumps after harvest in the second case. The heating of the seed has been found to impair neither the vitality nor the oil content of the seed.

Plant diseases are caused by fungi, bacteria or viruses and the best weapon to fight them with in India is the use of immune or resistant varieties, coupled with proper cultivation and rotation methods. Direct

methods are also economic, and good instances of such work are furnished by Mysore where spraying arecanuts to prevent the nuts dropping and the coffee bush to prevent leaf disease is extensively practised.

Among improved implemets, mention may be made of the large number of improved ploughs being sold annually and of that most recent introduction, the pneumatic tyre for bullock carts. The latter has been found to result in 50% increase in the hauling capacity, in less strain and jerking and fewer sore necks.

The scientific worker in India will find a wealth of material for research in agricultural problems intricate enough for the most ambitious. In all applied sciences, the most important problems often lie on the border line of two or more pure sciences and their successful solution leads to an advance in general knowledge or to the opening up of new fields of scientific investigation.

THE INDIAN SUGAR INDUSTRY 1934-35.

"The production of sugar directly from cane in modern factories in India has continued its course of expansion and attained a record figure during the year 1934-35, in spite of the fact that the cane crop was damaged in certain areas," states the review of the Sugar Industry of India compiled by the Sugar Technologist to the Imperial Council of Agricultural Research.

The production of sugar from gur remained almost stationary whilst that by the Khandsari process registered a further decline.

The current cane season 1935-36 has been exceptionally favourable to millers. The acreage under cane is larger than in any previons year, the increase in the United Provinces (which contains approximately 56 per cent of the total Indian cane acreage and accounts for 55 per cent of the total Indian production of factory-made sugar) being 22 per cent over last year's acreage. At the same time the crop is generally healthier than in the previous year, whilst well-distributed winter rains have provided the necessary humidity to enable the crop to remain in the fields till late in the season. As a result of the larger cane crop, gur prices have declined and a larger quantity is expected to be refined this year.

The effect of these all-round favourable conditions has been an

increase in the total production of sugar which is estimated at approximately 106,000 tons above the previous year's production. A forecast of sugar production (excluding gur) in India from cane factories, gur refineries and khandsari concerns for 1936-37 furnished by the Sugar Technologist estimates the total production of factory sugar in 1936-37 at 804,000 tons as against an estimate of 724,000 tons in 1935-36. The actual for 1934-35 was 618,000 tons. Production of khandsari sugar is estimated at 100,000 tons in 1936-37, 125,000 tons in 1935-36 as against an actual production of 150,000 in 1934-35. Thus the total production of all kinds of sugar (excluding gur) are: in 1934-35 actual 768,000 tons, 1935-36 estimated 849,000 and estimate for 1936-37 904,000 tons.

Noteworthy Features.—The Sugar Technologist notes that the present season has been noteworthy for the disturbed marked conditions. High opening prices and a strong market were followed within the short space of a few weeks by a sharp decline and an almost complete disappearance of demand. It is, however generally recognised now that the present situation has brought into prominence the weakness of the existing marketing organisation for sugar in India. It has, in particular, emphasised the necessity firstly, for a more uniform and generally agreed basis for grading of sugar (in place of the present system under which sugars produced by different manufacturers and said to be of the same grade are, in fact, of widely different qualities), and secondly for the adoption of terms of sales contracts which would take equal account of the needs of the manufacturer and the merchant.

The net production of gur in India is estimated at 3,692,000 tons as against 3,477,000 tons in the preceding season.

The production of sugar by modern factories and refineries in India was 515,059 tons in 1933-34. Adding to this total an estimated production of 200,000 tons of sugar manufactured by the indigenous process the total production for 1933-34 amounts to 715,059 tons. In 1934-35 production of sugar direct from cane amounted to 578,115 tons. The quantity of sugar manufactured by refineries and by the indigenous process during 1934-35 is estimated at 40,000 tons and 150,000 tons respectively. The total production thus amounts to 768,115 tons.

Trade Statistics.—Exports of sugar from India by sea amounted to 363 tons valued at Rs' 63,061 as against 425 tons valued at Rs. 64,451 last year.

Imports of foreign sugar excluding molasses, into British Indian ports (exclusive of imports into Kathiawar ports) during 1934-35, amounted to 222,900 tons valued at Rs. 211 lakhs, compare with 261,300 tons valued at Rs. 270 lakhs in the previous year. Java sugar imports amounted to 175,900 tons as against 194, 400 tons in the previous year. Imports of beet sugar also decreased to 26,811 tons valued at Rs. 24 lakhs as compared with 27,556 tons valued at Rs- 21 lakhs. The quantity of foreign sugar imported through Kathiawar was 27,580 tons against 26,370 tons in 1933-34. Re-exports of imported sugar from India showed a considerable decrease having gone down from 11,526 tons valued at Rs. 7,25,602 in 1931-34 to 2,604 tons valued at Rs. 6,09,814 in 1934-35. Exports through Indian and Burmese frontiers amounted to 34,034 tons as against 33,110 tons in 1933-34. The net quantity available for consumption in India during 1934-35 was 1,014,898 tons as against 931,877 in 1933-34. Imports of molasses amounted to only 415 tons as against 2,401 tons in 1933-34. India's own production of molasses is estimated at 410,000 tons during 1934-35 an against 430,000 tons last year. Imports of confectionery exclusive of jams and jellies amounted to 1,360 tons valued at Rs. 17,93 lakhs compared with 1,139 tons valued at Rs. 17.49 lakh. During the year under review 35,418 lbs. of saccharine valued at Rs. 2,42,447 were imported as against 34,662 lbs. worth Rs. 2,42,858.

Survey of Position.—Surveying the sugar position the Sugar Technologist observes that throughout 1934-35 world prices continued low, being influenced by surplus stocks. The Indian market was less responsive to the conditions prevailing in the world markets, the home industry being sheltered against competition by a protective tariff. Indian requirements are, however, not yet entirely met from home production. The agricultural condition of the sugar cane crop during the year was not very favourable The cane crop throughout the area covered by the district of Meerut and Muzaffarnagar in the U. P. and the major portion of the Punjab was badly damaged due to the adverse climatic conditions and an attack of Pyrilla and other insect pests.

The area planted with sugar cane is estimated at 3,471,000 acres as against 3,308,000 acres last year. The total yield of raw sugar (gur) is estimated at 5,085,000 tons showing an increase of 4 per cent over last year's yield of 4,872,000 tons. In addition to the area for which particulars are given above, the crop is grown in a small scale in certain other tracts in India, the average area of which for the last five years has been 125,000 acres with an estimated production of 183,000 tons.

Nineteen new sugar factories were built for working in 1934-35, making a total of 142 cane factories in India 130 of these 142 factories are reported to have worked during the season 1934-35.

The value of sugar machinery imported into India during 1934-35 was Rs. 1,05,45,439 as against Rs. 3,36,38,814 during 1933-34. For the first time machinery was imported from Java and Japan.

Gleanings

A soy bean Laboratory in the U. S. A.—To follow the march of the versatile soybean, America's fastest growing crop the Department of Agriculture with the cooperation of twelve North Central States, has established a soybean research laboratory at the University of Illions at Urbana.

There Federal scientists will try to uncover new industrial uses for soybeans, assemble more facts on the effects of different processes on the quality and quantity of soybean products and test different varieties to determine their adaptability for industrial use.

Soybean acreage has more than doubled in the last few years. In 1935, nearly 5,000,000 acres were planted in soybeans yielding a crop of more than 40,000,000 bushels. What are the reasons for the boom in soybeans ? In addition to the demand for food, feed and industrial uses, Federal experts point out that their immunity to chinch bugs and other pests, the good prices they command compared with other grain crops, their high seed yield and their powers of resistance to drought all contribute to their popularity.

Soybeans have a wide range of industrial and dietary uses. Industrially, they are used for making paint. enamel, varnish, glue, printing ink, rubber substitutes linoleum and insecticides. They also find a place in such food products as flour, breakfast cereals, candles, roasted beans with a nutlike flavour and so on. (*New York Times*).

Graduate Farmers.—The Punjab Government has a scheme for trying the experiment of making university graduates farmers. Shortly a Board including the Commissioner will be constituted to select proper graduates for the purpose. The idea is to allot two squares of land to over a hundred graduates but these persons must otherwise be in possession of land and should be prepared to work the land themselves

and not leave it in the hands of tenants only. In fact, it is being considered whether it would be better not to let these graduates acquire proprietary rights and give them a sort of permanent tenancy so that they may stick to the land. The scheme is being worked out and it appears that the idea of the authorities is that the houses of these people, though made of mud, should be of a design for the middle class family having their garden and lawn for tennis court.

The Government would give all assistance necessary to make graduates develop community life and live in concord, irrespective of difference in religious beliefs. Club life and games would be encouraged. Thus the experiment is to be tried on the lines of providing such amenities of life as are normally wanting in rural areas and the presence of which in towns make the intellectual classes drift to towns.

Milk bars in England.—A syndicate has been formed to open in and around London and in the provinces bars for the serving of non-alcoholic drinks of which milk will be the basis. Milk bars were successfully established in Australia about three years ago, and it is stated that in New South Wales they practically doubled the milk consumption in one year. The idea is to sell milk beverages in attractively equipped and easily accessible shops in much the same way as alcoholic drinks are served in a public house or saloon. The customer will be able to go traight to the open bar, order one of a variety of appetizing milk drinks, pay 4d. for it to the "barmaid" and leave within to minutes. The first of these bars was started last week at 68, Fleet Street, and the syndicate proposes to have eventually 500 of them in operation.

Control of Flies.—It is common knowledge that flies breed in manure and other refuse matter where their young ones-called 'maggots find plenty of food for their growth and development. with knowledge of the habits and life history of the fly it is possible to prevent its multiplication. This is by the use of what are known as fly maggot traps which work on the principle of attracting flies to fresh manure in a receptacle for egg-laying and trapping and destroying the maggots that hatch out making use of their migratory instinct. The trap consists of a rectangular wooden frame 9″ x 2' x 2' fitted with ½″ mesh wire netting on all sides, open at the top and provided with a plank at the bottom about 6', from the ground level. All round the trap at the level of the plank is

a U-shaped drain of galvanized iron fitted with ledges on either side, slanting towards the drain. The drain is filled with water which can be drained when necessary through a hole at the bottom on one side which is plugged with a cork. The trap is placed near cattle sheds or other places where flies abound and fresh manure is put into it daily in small quantities so that it gets filled in four or five days. Attracted by the fresh manure, flies come and lay eggs. The maggots that hatch out begin to wander about and move towards the outside and, in so doing, come out through the meshes o' the wire netting and fall into the drain round the trap and are caught. These are collected daily and destroyed. The water in the drain is also renewed. To provide a continuous supply of fresh cowduug for egg-laying and also to ensure thereby continuous trapping of maggots every day, instead of a single trap' a set of three is used, the baits in each being put in one after the other so that by the time the third trap gets full the first one would have got exhausted and could be renewed.

Maggot traps may be made in any design provided the principles of their working are borne in mind. A simpler and cheaper trap working almost as efficiently as the one described above has been devised by making use of a galvanised sheet of iron 6' x 3'. the sheet is bent along the length to form a trough and hung up a little above ground level. Manure is put in as in the case of the former trap in small quantities every day until it gets full. The maggots in the manure travel along the length of the trough and drop down at both the ends of the trough and are caught in two shallow wide basins (earthen basin will serve well) containing water placed exactly under the two open ends of the trough.

A rust resistant wheat.—After twenty years of patient research-cerealists of the Dominion Experimental Farms of Canada, have develop, ed a rust-resistant wheat and distribution of seed in two to four bushel quantities may be made to Western Canada farmers in the spring of 1937 This important announcement was made in Ottawa coincident with reports of extensive rust damage to wheat crops in Manitoba and parts of Saskatchewan. The Department of Agriculture plans to retain control of the rust-resistant strains of wheat until sufficient seed has been produced to permit of reasonably wide distribution. The new strains have been achieved through crossing varieties, but so far have not been given a name. The most promising results have been obtained from two families. The first family was derived from crossing Marquis with a highly resistant Durum variety known as Pentad, while the second resulted

from a cross between Marquis and Reward on a derivative of a Marquis-Emmer cross. Results of tests of both families are said to have fulfilled the expectation of the plant breeders.

Rural Reconstruction in Bihar.—A five-year plan of Village Welfare has been launched by the Government of Bihar with funds from the Government of India grant for rural development. It is proposed to open four centres in selected places, one in each division of the province, for introducing and carrying out a programme of village welfare and rural reconstruction. Each centre will comprise a group of 5 to 10 villages convenieniently situated. It will have a Welfare Officer, a guide or supervisor, an agricultural kamdar and a trained Dai. The welfare officer will be in charge of the whole work at the centre. The others will be subordinate to him and work under his direction. Ordinarily, village sanitation and public health, spread of primary education and agricultural improvement should be included in the programme of welfare work. But other items may be taken up as and when circumstances permit. For employment as Welfare Officer only such persons will be selected as are known to have a liking for the work and as will be prepared to live in the villages and work for and amongst villagers. Preference will be given to men with secondary or university education and if possible, with previous experience of village welfare work.

Electrocuting insect enemies.—Two ingenious professors of entomology at the University of California have developed a method whereby what the American fruit grower and market gardener would describe as "bugs" meet with a sudden and sultry end. A small wire cage, livened up with a sufficient dose of electricity, is set on a post in a garden or orchard. Inside it, is a luminiscent tube which lures the flying insects on until they strike the surrounding cage and are electrocuted. In this variant of the moth-and-candle theme the professors have found that different insects have a preference for different colours and they hope in time to have worked sufficiently through the chromatic scale until of the chief fly-by-night pests each has something coming to it. The artichoke fly and the grape leaf hopper are already finding life more dangerous and brief in certain districts of California, and the entomologists have next got the condlin moth on their list, and she certainly never will be missed by the apple-grower.

Fruit Cultivation in Baroda.—A comprehensive move for popularising fruit cultivation in the State by way of granting cash prizes of Rs. 25 each, four in number in each district every year for the best efforts made

by the agriculturists on their holdings in this direction besides a number of facilities granted and Government unoccupied land made available for the purpose at concession rates of assessment etc. is indicated in an order issued by the Baroda Government on the recommendations of a committee appointed to suggest ways and means for extension.

The order provides that Government lands remaining uncultivated for two years or more should be given for tree-planting at concession rates of assessment extending over a period of ten years *viz.*, absolutely free for the first five years and half the assessment for the remaining term, that the land should be equitably distributed among the landholders of the village large and small without allowing any single individual or groups of influential men securing the lot. The Government have directed the Agricultural Departement as well as the Garden Superintendent to grow seedlings of the best varieties suitable to local conditions in each farm for supply at cost price and also place the services of their inspectros for expert advice in the matter, to all holding land either private or belonging to Goverment under fruit cultivation. The Goverment also consider that tree-planting may be usefully taken up on a co opeative basis and socieies formed for the purchase and maintenance of power pumps required for irrigating gardens and for obtaining such other conveniences may be easily available under group syatem.

The Influence of Method of Picking on the Quality of Cambodia Cotton.— Frequent complaints made by consumers of Indian cottons both in India and abroad as regards the amount of trash present in Indian cottons are mostly due to careless and faulty picking. The method usually employed by the ryots was to let the coolies collect the seed-cotton in gunny bags, who gathered all available bolls indiscriminately, regardless of the fact whether they were fully ripe or green and immature. The kapas were later removed and sold at the nearest shandy without being dried, and the lint obtained from it was generally moist, weak and the seed was found to be green and not fully ripe.

The Madras Agricultural Department recommended an improved method according to which, the kapas were picked only from the fully opened and mature bolls leaving the loucles in the plant itself. This not only gave mature lint and ripe seed, but also the seed-cotton contained fewer leaf bits and was generally cleaner than that obtained according to the cultivator's methods. Two samples picked according to these two

methods were tested at the Technological Laboratory, Matunga. The results showed that cotton picked according to the improved method was superior in all respects. (Indian Central Cotton Committee Technological Laboratory, November 1935, Leaflet 5). It contained a higher percentage of mature fibres, gave 3 percent. less total loss in the opening and cleaning processes, registered fewer breakages in the ring frame and the yarns spun from it were definitely stronger and less neppy than those given by the sample picked according to the cultivator's method. (*Current Science, Februrry 1936*).

World's wheat stocks.—Thanks to reduced acreage and drought, it appears probable that the world carry-over of wheat on August 1 next, will be less than 17,000,000 tons. In 1934, the carry-over exceeded 31,000,000 tons. This forecast is contained in a report on "Grain Crops", covering the period 1928 to 1935, issued by the Imperial Economic Committee. This shows the improvement which has recently taken place in the statistical position of the wheat trade. The encouragement given to agriculture, especially to wheat-growing in various European countries together with the increased restrictions on imports, greatly reduced the demand for overseas grain, it is stated, and led to the accumulation of large stocks. This situation has altered materially in the past year, and expectation of the gradual liquidation of the large supplies led during 1935 to an advance in price to the highest level since 1930. The 1934 area and production of wheat, barley, oats, maize and rice were lower than the average for 1928-1933 and the Empire's share of the total stood at about 23 percent. Though for rice alone 56 percent of the world production was grown within the Empire.

The most notable change during the eight years was the increased production of wheat, barley and oats in the U. S. S. R. which has recently replaced the United States as the world's largest producer of these three commodities. Within the Empire, Canada was formerly the largest producer of oats and barley, but India now leads in these crops as well as in maize and rice. International trade in these cereals and in wheat flour fell generally, with United States the chief sufferer. Exports of these six products from the United States amounted to 5,646,000 tons in 1928, but, after a steady decline, to only 547,000 tons in 1935, Canadian exports, which, at 11,759,000 tons were abnormally large in 1928, fell to 5,251,000 tons in 1935. From Australia exports have fallen since 1931, but have remained above the level of 1928-1930.

The statistics of the importing countries show the other side of the picture. Imports of these six commodities into France Belgium, Netherlands, Germany, Switzerland and Italy, fell from 17,479,000 tons in 1928 to 8,861,000 tons in 1935. The Empire's net position with regard to the trade in each of these products uuder review is shown. The Empire has for sale to foreign countries a considerable surplus of wheat and flour, which frequently amounts, in the case of wheat alone, to more than 2,000,000 tons. India normally has a surplus of rice suffcient to meet the import requirements of the other parts of the Birtish Commonwealth, but for the secondary cereals it is necessary for the Empire to have recourse to foreign. sources of supply. (*The Hindu*).

Tobacco Tree.—Tobacco plants as tall as trees are among the strange vegetation of the lower Andean country now being investigated by an expedition from the University of California under Prop. T. P. Goodspeed. One of the biggest tobacco growths measured by Prof. Goodspeed was sixty feet high. The expedition is engaged primarily in a search for wild relatives of the common cultivated tobaccos, to be used in hybridisation experiments. Seeds of many other kinds of plants, however, are being collected. (*Current Science' Feb. 1935*).

Current Research

Some new seedling diseases of sugarcane.—L. S. Subramaniam (*Ind. J. Agric. Sci.* 6, 11) Helminthosporium balodes and H. tetramera have been found to be the cause of seedling diseases of sugarcane. H. halades is an active parasite while H. tetramera is a weak one. These two fungi cause foot-rot of the seedlings, and are here recorded for the first time, on sugarcane. Pythium graminicolum has been found on sugarcane for the first time in India as the cause of a seedling disease. This fungus when cross-inoculated attacks canes, wheat, oats, and barley very vigorously and maize and jowar to a slight extent. (*Author's abstract.*)

A biochemical study on the decomposition of farmyard manure and sulphate of ammonia in the paddy soils of the Central Provinces B. K. Mukerji and S. L. Vishnoi, (*Ind. J. Agric. Sci.* 6, 17). The microbiological and chemical processes involved in the decomposition of organic and inorganic fertilisers, such as farmyard manure and sulphate of ammonia in two of the typical rice soils (matasi and dorsa) of the Central Provinces have been studied in the laboratory under the usual water-logged conditions of the

paddy-field. The results have further been compared with those obtained under aerobic soil conditions. The entire investigation consists of a series of comparative tests carried out in each of these soils on the changes in bacterial numbers, ammonia, nitrate and nitrite contents, corbon dioxide production and nitrate producing capacity in culture solutions. Application of manures depresses the bacterial population in the heavier soil while no such effect is noticed in the lighter soils. An inverse relationship exists between the bacterial numbers and ammonia accumulation. The numbers of the strictly aerobic bacteria, although much lowered as a result of water-logging, are sufficiently large to prove the presence of a fairly abundant supply of oxygen in the rice soils during the crop season. Submerging the soils causes a rapid disappearance of accumulated and added nitrate. The varying effect of the manures under the two different environmental conditions on the production of carbon dioxide, and nitrogen changes with regard to the denitrifying organisms in the soils have been discussed. (*Authors' abstract*).

Utilisation of Oranges and Limes.—By B. N. Banerjee, and N. K. Ranga Rao, (*Agriculture and Live Stock in India*, Vol. VI, Part II March 1936). Oranges, limes, and lemons are grown in large but isolated areas in India. The fruits are available only at certain seasons, and no efforts are made to preserve the fruit or bottle the juice. Efforts are being made elsewhere to preserve the pulp and juice, especially the anti-scorbutic principle. Using the citrus fruits of the Madras Presidency, results are presented in detail of the way in which citrus fruit pulp or juice can be preserved or stored. The very best fruit alone should be used when it has the highest sugar content and richest flavour. The juice after extraction should be de-aerated and not allowed to come in contact with air, preferably worked in an atmosphere of inert gas like hydrogen, nitrogen, or corbon dioxide. All the pulp should be eliminated from the juice and the coagulable fraction in solution removed after precipitation. Only terpene-less lemon oil or orange oil should be used to make up the flavour, but not more than 0.005 per cent. The juice can be flash pasteurised and vacuum sealed for storage or frozen hard quickly and stored below—18°C. out of contact with air. Acidity of the juice should be maintained at more than one per cent and sugar added to make the ratio of acid to sugar from 1 to 7-14 per cent. Sulphur dioxide gas, or sodium benzoate can be used as an antiseptic but not more than 0.05 per cent in amount. Silver, block tin, monel metel, duraloy, aluminium or stainless steel alone can be used. Iron and copper are positively harmful in very small amounts.

Vitamin A Assay of Ghee, Part II By B. N. Banerjee, and S. D. Sunawala, (*Agriculture and Live Stock in India*, Vol. VI, Pt. II, March 1936). The first paper (Banerjee and Sunawala, 1935) disccussed in detail the methods that are available for estimating the vitamin A in butter or ghee. Additional data are presented here with blue value and ultra-violet absorption figures obtained from a Hilger Vitameter, so that the problem of vitamin assay of ghee be properly taken up by chemists and analysts in India. Direct blue value on ghee is a quick and ready method of assaying ghee. Blue value *via* unsaponifiable matter is a more accurate method of determining vitamin potency. The ultra-violet absorption value rises higher on storage, while, the blue value goes down.

Effect of soil organic matter and nitrogen on the ripening of sugarcane By H. N. Batham, M. A., F. I. C. S., and L. S. Nigam L. Ag., F. I. C. S., (*Agriculture and Live Stock in India* Vol. Vi, Part II March 1936). The factories manufacturing sugar direct from canes work only for a limited period in the year and remain closed for the rest. Attempts are being made to prolong the working season of these factories by evolving canes of different periods of ripening calling those as early canes, which ripen within a shorter period and those as late, which take longer time to ripen. It is not the individual characteristics of cane varieties alone which conduce to ripening in a shorter or longer period but the characteristics of soils also influence their ripening period. It has been found that the same variety can be made to ripen early or late if cultivated on soils having different quantities of moisture, organic matter and nitrogen. Canes ripen more quickly on porous, well drained lands than on low-lying, retentive soils. This is proved from the analytical results of canes and soils of a farm in Campierganj, Gorakhpur. The poorer the soil is in organic matter, nitrogen and moisture, the earlier the cane crop will ripen and less will be its tonnage. With the increase of organic matter and nitrogen in the soil the maturation period of the cane crop is prolonged but an increase in tonnage takes place. Certain varieties of cane ripen early and others late. By taking advantage of these characteristics of canes and the amounts of organic matter and nitrogen in the soils the period of the supply of ripe canes to the market may perhaps be prolonged from September to May.

Some observations on the mosaic disease of sugarcane in the Punjab. Jai Chand Luthra and Abdus Sattar (*Ind. J. Agric. Sci. 5, 649*) Agriculture and Live Stock in *India, Vol.* VI. Part 1 January 1936.) In the Punjab only primary symptoms of mosaic *i. e.*, mottling of leaves occurs on

sugarcane. The secondary symptoms, *i. e.* dwarfing of canes, etc., have not been observed so far. The incidence and amount of mosaic on different varieties of sugarcane grown in the Punjab has been recorded. It has been found that the canes show the first symptoms of mosaic about one-and-a-half months after planting, and then the amount of infection goes on increasing till October. The results of field experiments carried out for three years on the sugarcane variety Co. 223 have shown that there is no significant decrease in the yield of cane, juice or gur (raw sugar) on account of mosaic. The quality of juice in Co. 223 also does not deteriorate on account of mosaic. Roguing can keep the disease within limit in those varieties only which are not very succeptible to mosaic. (*Author's abstract*).

Observations on sterility in the cow in India with recommendations for its control. R. I Kaura (*Ind. J. Vety. Sci. and Anim. Husb.* 5,30) Sterility in the cow is responsible for extensive economical loss in all countries where cattle breeding and dairying are important industries, and with the increasing attempts which are being made to produce cattle of a high milk strain in India it is becoming an urgent problem. From November 1929 to March 1935 opportunities were made use of to study this condition at the Government Cattle Farm, Hissar, with about 5,000 head of cattle, of which the dairy herd was of particular interest. Reference has been made to the physiology of reproduction so that the pathology of the reproductive system may be easily understood. The causes of sterility have been dealt with in detail from the structural, functional and bacterial aspects. For diagnosis, breeding records, environmental conditions, a general examination of the external genitals and the bodily condition, and a special examination of the genital organs perrectum and pervaginam were made use of. Animals considered curable were treated and restored to breeding usefulness, whereas hopelessly sterile animals were either destroyed or auctioned to butchers and their genital organs studied at post morten. Prophylaxis and treatment have been discussed in detail, keeping in view the variety of causes and the nature and extent of the condition. A number of useful illustrations are also included in the Article. (*Author's abstract*).

Jowar (Sorghum vulgare) poisoning in cattle. G. K. Sharma (*Ind. J. Vety. Sci. and Anim. Husb.* 5,376) The subject of plant poisoning in animals has received very little attention in India, which is mainly due to the difficulty in its diagnosis from the clinical symptoms alone, and the fact that the majority of field vaterinarians are unable to secure

the collaboration of a chemist for analysis of the suspected fodder or ingesta. The paper deals with sorgum (Sorghum vulgare) poisoning which is by far the most common form of plant poisoning in India. This plant although normally forming a wholesome fodder for animals, is liable, under certain conditions to acquire highly toxic properties with the production of hydryanic acid. A simple chemical test, suitable for adoption under field conditions, is described for the detection of this acid in the plant itself. (*Author's abstract*).

The control of loose smut of wheat in North Bihar by the solar energy and sun-heated water methods. By M. Mitra and M. Taslim, (*Agri. and Live Stock in India*, Vol. VI, Pt. I, Jany. 1936) In a recent paper, Luthra and Sattar (1934) have described two modifications of the well-known hot water treatment for controlling loose smut of wheat caused by Uestilago tritici (pers.) Jens. In one of these methods solar energy is employed for purposes of heating the water required to soak the effected seed, and in the other the pre-soaked seed is directly exposed to the sun's rays, Not only are these methods easy of application but also where the sun temperature is sufficiently high, as in the Punjab, they do not entail any expenditure, since the sun is quite capable of warming the water or the directly exposed seed to the required extent. The cost of fuel for artificial heating is thus obviated and the treatments can easily be applied by an ordinary cultivator without involving the use of a thermometer or the assistance of a trained man. During 1934-35 the solar heat method was given a trial at Karnal (Punjab), 258 maunds of heavily infected seed being treated. No untreated control was kept but there is strong evidence that the incidence of smut was greatly reduced by this treatment. With a viw to determining whether these methods could be applied with equal success under conditions prevailing in Bihar, where the sun temperature also reaches a high figure on bright days during the smmer months, experiments were carried out at Pusa during 1934-35. Experiments carried out during 1934-35 showed that both the solar energy method (exposing pre-soaked wheat seed to the sun) and the sun-heated water method, as recommended by Luthra and Sattar (1934), can be applied with advantage for controlling wheat smut under North Bihar conditions. The wheat seed should be treated after harvesting and then properly dried and stored in air-tight containers.

The nutritive value of artificially dried grass and its effect on the quality of milk produced by cows of the main dairy breeds.—By S. J. Watson and

W. S. Ferguson. (*The Jour. of Agri. Sci.* Vol. XXVI, *Pt.* 2 April 1936). The artificial drying of grassland herbage and of other forage crops has recently assumed considerable importance. That artificial drying can produce a material of high nutritive value, as judged from chemical analysis and digestibility trials, has been shown by serveral writers. It has also been shown that artifiical drying does not materially affect the digestibility of the various constituents. Another important constituent of the green crop—the carotene—is retained in almost unimpaired amount by artificial drying. Recent work has demonstrated that the exposure of dried grass even to relatively low temperatures may result in a depression of the digestibility of the protein, and of the carotene content, the magnitude of the effect depending on the length of exposure and on the temperature. An experiment was carried out with two groups of ten cows, each made up of two Guernseys, two Ayrshires, two Friesians and four Shorthorns. The experiment was of the change-over type, the experimental period of 20 weeks being sub-divided into four periods of 5 weeks, each cow alternating between the two treatments. In two of the periods a normal winter ration of roots, hay and concentrates was fed. In the other two periods artificially dried grass replaced a proportion of the concentrates, an average of 8 lb. being fed per head daily. The two types of ration provided equal amounts of starch equivalent and protein equivalent, but the carotene intake was greater in the "dried grass ration." A statistical analysis of the difference in milk yields due to the contrast "Dried grass" *v.* "Control" revealed no signs of any effect, and if any actual effect does not exist, it is quite negligible for the 5-week periods of this experiment. A similar analysis on the fat content and solids- not fat figures revealed no sign of change in fat or solids-not-fat content due to treatment. An analysis of the butter yellow-colour figures was made, though it is pointed out that there are limitations to the interpretation of this analysis. The response to carotene in the ration is, however, quite obvious; it is most marked for the Guernsey breed. The condition of the cows remained good throughout the duration of the experiment, but they appeared to do better on the ration including dried grass, which showed a significant advantage over the ordinary winter ration in respect of weight increases. It is considered essential to increase the length of the periods in experiments of this type, more particularly when the effect of the ration on the colour of the fat in the milk is to be investigated, but that used was not far ifferent from the average type of material which might come on the market.

Crop Forecasts

1935-36

RICE

Final General Memorandum, All India.—This memorandum is based on reports received from the undermentioned provinces and States which comprise 97 percent of the total rice area in India. The statistics of acreage, outturn, etc., refer to both early and late crops in all the reporting provinces and States. The total area reported is 81,454,000 acres, as against 81,980,000 acres in the previous year. The total yield is estimated at 27,719,000 tons, as compared with 30,261,000 tons in 1934-35. The condition of the crop is reported to be good in Burma and fair elsewhere.

The average yield per acre works out at 762 lbs, as against 827 lbs in 1934-35, 833 lbs in 1933-34, 841 lbs in 1932-33 and 876 lbs in 1931-32. In addition to the areas for which particulars are given above, rice is also grown in certain other tract in India, and the average area so grown for the five years ending 1933-34 was estimated at 2,821,000 acres with a yield of 960,000 tons. The provincial reports are summarised below. The figures in brackets following the name of each province or State indicate the average percentage of the area under rice cultivated in that tract to the total area under rice in India based on the figures for the five years ending 1933-34

Central Provinces and Berar.—(7.8 per cent) reported in December forecast, the area is estimated at 6,801,000 acres (1.136,000 acres being in eleven Indian State), as compared with 6,762,000 acres last year. The yield is estimated at 1,730,000 tons (245,000 tons being in the Indian States), as against 2,059,000 tons last year. The average outturn for the province as a whole is, as reported in December last, 88 per cent of the normal, as against 107 per cent last year.

Rice crop in Foring Countries.—From information specially obtained, it appears that the estimates of the rice crop of Formosa for 1935 place the area and yield at 1,767,000 acres and 45,272,000 bushels (or 1,280,000 tons), as compared with 1,648,000 acres and 45,107,000 bushels (or 1,275,000 tons) in 1934. In Siam, the total production of paddy was estimated at the end of November, 1335, at 81,000,000 piculs (or 4,821,000 tons) as against 86,400,000 piculs (or 5,148,000 tons) at the corresponding period of last

year. The exportable surplus is placed at 40,100,000 piculs (or 2,387,000 tons), which is equivalent to 30,000,000 piculs (or 1,786,000 tons) of rice and rice products. The second estimate of the rice crop of Japan proper for 1935 is placed at 57,060,000 koku (or 8,003,000 tons) as compared with 51,840,000 koku (or 7,271,000 tons), the actual yield of the preceding year. In Cohin-China, the area and yield of the rice crop of 1935-36 are estimated at 5,216,000 acres and 2,615,000 tons. From the last available bulletin published by the International Institute of Agriculture, Rome, it appears that the estimates of the 1935 crop of the United States of America are 789,000 acres and 763,000 tons of rough rice, showing an increase of one per cent in area but a decrease of same magnitude in yield as compared with 1934. In Italy, the area and yield of rough rice are 340,000 acres and 647,000 tons, as against 323,000 acres and 607,000 tons in 1934. In Egypt, the area under rice in 1935-36 is estimated at 488,000 acres with a yield of 710,000 tons of rough rice, as compared with 407,000 acres and 505,000 tons in the preceding year. In Chosen (Korea), the area under rice is placed at 4,127,000 acres, as against 4, 195,000 acres in 1934. The production of rough rice is estimated at 3,261,000 tons, as compared with 3,054,000 tons in the preceding year. *The Ind. Trade Journal.*)

WINTER OIL SEEDS

This forecast is based on reports received from provinces and States where rapeseed, mustard and linseed are grown to any considerable extent. These provinces and States contain 95 per cent of the total area in India under rape and mustard and 93 per cent of the total area under linseed in India. The reports relate generally to conditions upto the middle of February. Weather conditions were not generally favourable, the crops having suffered from insufficient rains, frost and hailstorm. The present condition of the crops appears to be fair.

RAPE AND MUSTARD

The total area under rape and mustard, so far reported, amounts to 2,624,000 acres (excluding the "mixed" crop* of the United Provinces and also the crop of the Central Provinces and Berar for which no estimates are available at present). This is 6 percent below the corresponding estimate (revised) of last year. The detailed figures for the provinces and States are:—

*The area under rape and mustard and linseed sown interspersed with other crops such as, wheat, gram, barley, etc., in the United Provinces and also the area under rape and mustard in the Central Provinces and Berar are reported in the Final General Memorandum issued in June

Second Forecast March

Provinces and States.	1935-36 Acres.	1934-35 Acres.	Increase ( ) or Decrease (–) Acres.
United Provinces (unmixed crop)	209,000	208,000	1,000
Punjab.	586,000	693,000	—107,000
Bengal.	711,000	724,000	— 13,000
Bihar and Orrissa.	559,000	600,000	— 41,000
Assam.	335,000	345,000 (b)	— 10,000
Bombay (a)	132,000	135,000 (b)	— 3,000
North West Frontier Provinces.	49,000	44,000	— 5,000
Delhi.	4,000	4,000	...
Alwar (Rajputana).	18,000	21,000	— 3,000
Baroda.	10,000	15,000	— 5,000
Hyderabad.	11,000	10,000	— 1,000
Total.	2,624,000	2,799,000 (b)	—175,000

(a) Including Sind add Indian States. (b) Revised.

LINSEED

The total area under linseed is reported to be 2,630,000 acres (excluding the "mixed" crop* of the United Provinces for which no estimate is at present available), as compared with 2,694,000 acres, the corresponding estimate (revised) of last year. The detailed figures for the provinces and States are:—

Second Forecast March

Provinces and States.	1935-36. Acres.	1934-35. Acres.	Increase ( ) or Decrease (–) Acres.
C. P. and Berar (a)	1,995,000	1,095,000(b)	...
U. P. (unmixed crop).	229,000	214,000	12,000
Bihar and Orissa.	543,000	600,000	— 57,000
Bombay (a)	112,000	117,000	— 5,000
Bengal.	98,000	122,000	— 24,000
Punjab.	29,000	28,000	1,000
Hyderabad.	388,000	385,000	3,000
Kotah (Rajputana).	94,000	92,000	2,000
Bhopal (Central India).	45,000	41,000	4,000
Total.	2,630,000	2,694.000(b)	— 64,000

(a) Including Indian states. (b) Revised. *See footnote pre page.

Oilseeds in Foreign Countries.—From the latest available bulletin published by the International institute of Agriculture, Rome, supplemented by information specially obtained by cable, it appears that the area and yield of linseed in the United States of America for 1935 are estimated at 2,071,000 acres and 15 million bushels (or 375,000 tons), as against 969,000 acres and 5.2 million bushels (or 130,000 tons) last year. The estimates for the Canadian linseed crop of 1935 are 214,000 acres and 1,472,000 bushels (or 37,000 tons), as compared with 227,000 acres and 910,000 bushels (or 23,000 tons) in 1934. In the Argentine, the area and yield of the linseed crop during 1935-36 are estimated at 5,170,000 acres and 1,259.000 tons, as against 7,105,000 acres and 1,993,000 tons in the preceding season. (*The Ind. Trade Jour.*)

WHEAT

Third Wheat Forecast.

All India. This forecast is based on reports received from Provinces and States, which comprise a little over 98 per cent of

(1) Area.

Provinces and States.	1935-36 (April 1936) (1000 acres)	(1934-35 (April 1935) (1000 acres)	Increase ( ) or Decrease (−) (1000 acres)
Punjab (a).	10,221	10,037	184
United Provinces (a).	7,664	7,890	— 226
C. P. and Berar (a)	3,521	(b) 3,689	— 168
Bombay (a)	2,106	2,240	— 134
Bihar and Orissa.	1,142	1,197	— 55
N. W. F. Provinces.	995	926	69
Sind (a).	1,195	1,159	36
Bengal.	127	155	— 28
Delhi.	38	34	4
Ajmer-Merwara.	27	28	— 1
Central India.	2,000	(c) 2,250	— 160
Rajputana.	1,563	1,463	100
Gwalior.	1,647	1,548	99
Hyderabad.	1,237	1,264	— 27
Baroda.	71	73	— 2
Mysore.	2	2	...
Total.	33,646	(b) 33,955	— 309

(a) Including Indian States. (b) Revised.

the total wheat acreage of India. The returns, therefore, cover practically all the important wheat-growing areas in India. The condition of the crop stated below generally relates to that prevailing in the latter half of march. The total area now reported is 33,646,000 acres, as against 33,955,000 acres (revised) at the corresponding time of last year, showing a decrease of one percent. The total yield is now estimated at 9,698,000 tons, as compared with 10,144,000 tons, the corresponding estimate (revised) of last year showing a decrease of 4 percent. The present condition and prospects of the crop are on the whole, fairly good. The detailed figures are as follows:—

(2. *Yield.*

Provinces & States.	1935-36 (April 1936). (1000 tons)	1934-35 (April 1935). (1000 tons)	Increase ( ) or Decrease (—) (1000 tons)	Yield per acre. 1935-36. lbs.	Yield per acre. 1934-35. lbs.
Punjab. (a)	3,337	3,548	— 211	731	792
United Provinces (a)	2,935	2,861	74	858	812
C. P. & Berar (a)	675	(b) 819	— 144	429	497
Bombay (a)	408	437	— 29	434	437
Bihar and Orissa.	414	508	— 94	812	951
N. W. F. Provinces.	250	230	20	563	556
Sind. (a)	306	(b) 319	— 13	574	617
Bengal.	33	51	— 18	582	737
Delhi.	12	19	— 7	707	1,252
Ajmer-Merwara.	8	9	— 1	664	720
Central India.	368	(b) 407	— 39	394	405
Rajputana.	386	379	7	553	580
Gwalior.	400	387	13	544	560
Hyderabad.	139	155	— 16	252	275
Baroda.	27	15	12	852	460
Mysore.	(c)	(d)	...	482	407
Total.	9,698	(b) 10,144	— 446	646	669

Central Provinces and Berar (10 per cent)—The area is now estimated at 3,521,000 acres (76,000 acres being in the India states), which is 5 per cent below the corresponding area (revised) of last year. The yield is estimated at 675,000 tons (10,000 tons being in the Indian States), as against 819,000 tons the corresponding yield (revised) of last year, or a decrease of 18 per cent. The weather during March was warm and occasionally cloudy with light showers of rain in most districts. Har-

vesting has been completed except in the north, and threshing and winnowing operations are in progress. The estimated outturn for the British districts reported in the second forecast issued in March last remains unaltered in nine districts; but it has been lowered in others owing to damage caused by hail and rust. As a result, the provincial outturn has now been placed at 77.5 per cent of the normal, as against 81.5 per cent reported in the second forecast and 90 per cent reported at this time last year.

Wheat in Foreign Countries.—From information specially obtained, it appears that the estimates of the wheat crop of the United States of America for 1935 are 50 million acres and 603 million bushels (or 16.2 millions tons), as compared with 42.2 million acres and 497 million bushels (or 13.3 million tons) in 1934. The area sown with winter wheat for the 1936 crop is estimated at 47,529,000 acres; and the production is placed at 493,166,000 bushels (or 13,210,000 tons). The yield of the Canadian wheat crop of 1935 is estimated at 277,339,000 bushels (or 7,429,000 tons), as against 275,849,000 bushels (or 7,389,000 tons) in 1934. The exportable surplus at the end of December last was estimated at 247 million bushels (or 6.6 million tons). The area sown with winter wheat for the 1936 crop is estimated at 514,000 acres, which is 25 per cent below that of the preceding season. The area sown with winter wheat in the U. S. S. R. for the 1936 crop is estimated at 34,721,000 acres, which is 7 per cent above that of the preceding season. The estimates of the wheat crop of Australia for 1935-36 are 11,945,000 acres and 140 million bushels (or 3.75 million tons), showing a decrease of 4 per cent in area but an increase of 4 per cent in yield as compared with the preceding year. The area and yield of the wheat crop of Argentina for 1935-36 are estimated at 11,913,000 acres and 3,857,000 tons, as compared with 17,155,000 acres and 6,447,000 tons in 1934-35.

Calendar of Operations

BY R. N. SINHA

FLOWERS

May.—The cold weather annuals will have finished by now. Their seeds should be gathered and cleaned and dried and preserved in air-tight bottles or tins with labels for next year's use. Seeds like Aster, Pink, Phlox, sweet-peas, Petunias, Candytuft, Nasturtium, Cornflower, Alyssum,

Antirrhinum, Larkspur, Clarkia etc do not deteriorate for two or three years.

When the seeds have been collected, the plants should be pulled out as soon as possible, and the beds dug out to a depth of about 2 feet, and the excavated soil left exposed to sun and air for about 2 or 3 weeks.

Afterwards well rotted cattle-dung manure in the proportion of two of soil and one of manure may be well mixed with the soil and returned to the pits. Horse dung, night-soil or town sweepings can also be added with advantage, of course in a well decayed form.

Potting soil for general use may be prepared in the following form and kept ready for use during the rains.

2 Parts soil; silt preferable.
1 Part cattle dung.
1 Part leaf mould.
$\frac{1}{4}$ Part sand in absence of silt.
$\frac{1}{8}$ Part charcoal dust.

Seed beds should be prepared and kept ready for sowing early in June. These beds should be about $4\frac{1}{2}$ feet in width and 9″ higher than the ground level. The length may be according to requirements. A mixture of cattle dung and leaf mould manure in the proportion of half and half would make a suitable composition for seed beds. A layer of this about $1\frac{1}{2}$″ in thickness would be enough over the seed beds. Manures like horse-dung and Poudrette should be avoided for seed beds as far as possible. It would be worth while soaking the seed beds 10 or 12 days before the actual date of sowing the seeds.

The following seeds may be ordered for the rainy season.

1. Zinnia.
2. Balsam.
3. Cosmos.
4. Sunflower Big.
5. Sunflower small.
6. Celosia.
7. Gompherna.
8. Melampodium.
9. Torenia.
10. Hollyhock.
11. Marigold.
12. Cacalia.
13. Gillardia.
14. Calandula.
15. Datura.
16. Amaranthus.
17. Cleome (spider flower.)

Where hedges or borders are to be planted, a trench $1\frac{1}{2}$ feet deep and $1\frac{1}{2}$ feet broad may be dung and the soil exposed to the sun; If manure

is available easily, it may be added in the proportion of 3 to 1 and the trench filled in and kept ready for sowing the seeds or inserting cutting of hedges and borders.

The following varieties are suitable for hedges and borders :—

Hedges.	*Borders.*
1. Haematoxylon.	1. Eupatorium.
2. Ingadulcis.	2. Pedilanthus.
3. Dodonia.	3. Pedilanthus variegata.
4. Duranta.	4. Justicia.
	5. Althernanthera.

Surface drains should be eleaned and new ones dug, whenever necessary. Drainage is one of the important factor in plant life.

Caladium and Hamanthus bulbs should be removed from storage and made to sprout by about the middle of this month. Dhalia tubers should be potted in leaf mould for sprouting. Caladium and Hemanthus bulbs can be potted independently after separating the bulbs, the size of the pot depending upon the size of the bulbs. Put a little fine sand around about the bulbs while potting. Charcoal dust will be useful in caladium soil for obtaining good colours.

June.—The seeds obtained in the last month for the rainy season may be sown in two lots, first lot on or about the 6th and the second lot a week later. The seedlings will be fit for transplanting in about 2 to 3 weeks time.

Dahlia bulbs will be fit enough for separating by the 1st week These may be potted 6″ and 8″ pots, and lanter in 15″ pots.

Roses will have to be pruned and manured by about the 3rd week. Pruning need not be heavy in this season.

It is advisable to prune the ornamental and flowering shrubs also by the end of this month in order to keep them in shape and control, and to encourage their free flowering tendency.

This is the best time for sowing seeds or for planting cuttings of hedges and borders.

Cannas may be transplanted in this month. Violets and Geraniums in pots may be removed to some shady open verandah in order to protect

them from the rains or otherwise they would be spoiled.

The rooted cuttings of Eduard Rose may be potted in pots or planted in beds for budding ln the next cold season.

July.—Any operations which could not be finished in the last month may be carried out in this month with safety.

This would be the proper time for repotting pot plants.

Crotton cuttings may be planted in a mixture, of coarse sand and leaf mould manure. In this month Dahlias will be getting ready for putting in big pots.

Hanging baskets may be renewed. Rockeries also should be renewed or new ones planted. Whenever possible, the flower beds planted in the last month should be hoed or their soil loosened by a khurpee.

For obtaining good results, remove the first flowers of zinnias, which are generally single ones. Remove the side shoots of balsams, as flowers produced on the stem are always double full, and more showy.

VEGETABLES

May.—In order to have an early crop, the following vegetables may be sown by the 2nd or 3rd week of this month.

Maize.	Sponge gourds (Turai).
Snake gourd.	Ladies fingers (Bhendi).
Bottle gourd.	Cluster beans (Gewar Palli).
Pumpkin.	Cucumber.
Vegetable marrow (Dilpasand)	Tomoto (Occlimatized).
Brinjals	Chillies.

Artichoke tubers preserved in the ground may be given regular irrigation any time from the 2nd week of this month in order to help germination, so that plants may be ready by the 3rd week of June for transplanting.

June.—2nd sowing of the vegetables suggested in the previous month may be done in the 2nd or 3rd week of this month in order to have a regular and continuous supply. In addition to the above the following vegetable seeds may be sown at any time in this month.

Gooseberry (Tipari).	Sword beans (Tamtama).
Country beans (Sem),	Double beans.

Asparagus beans (cholai).
Goa beans (chaudhari).
Velvet beans (kach-kuri).
Rosella lal ambari).
Ashy gourd (hura kumhra).
Arum (ghunya).

Artichoke, chillies, brinjal and tomato seedlings would be ready for transplanting. Maize sown in the last month may be earthed up.

July.—Any vegetables those suggested in the previous months, could be sown in this month.

Special attention will have to be paid to the weeding and drainage of the standing crop.

Cucumbers, beans, snake gourds etc. would require supports for climbing. For cucumbers and beans branches of trees would be quite enough but for snake gourds mandua or machan will have to be provided.

Acclimatized lettuce seeds may be sown in this month.

Departmental News

Mr. N. R. Ramayya, Agricultural Assistant, is appointed to officiate as Extra Assistant Director of Agriculture in the Central Province Agriculture Service, Class II, and posted to Jubbulpure, vice Mr. Govind Prasad, appointed to officiate as Deputy Director of Agriculture, Northern, Circle, Jubbulpore.

* * * *

Leave on average pay for one month, is granted to Mr. Maniram Singh Barker, Extra Assistant Director of Agriculture Hoshangbad, with effect from the date on which he is permitted to avail himself of it.

* * * *

Mr. J. S. Gurjar, officiating Extra Assistant Director of Agriculture, is confirmed in the Provincial Agriculture Service, Class II, in the new scale of pay, with effect from the 1st May 1936.

* * * *

On reversion from foreign service under the Indian Central Cotton Committee, Mr. J. S. Gurjar is reappointed as Extra Assistant Director of Agriculture with effect from the 1st May 1936, aud is posted to Jubbulpore.

On relief by Mr. J. S. Gurjar, Mr. N. R. Ramayya reverts to his substantive post in the Subordinte Agriculture Service.

Leave on average pay for four months combined with leave on half average pay for twenty four months is granted to Mr. A. R. Padmanabha Aiyer, Extra Assistant Director of Agriculture attached to the Chemical Section, Nagpur, with effect from the 15th June 1936.

Examination Results 1935-36.

B. Ag. EXAMINATION, NAGPUR UNIVERSITY.

Second Division.

R. L. Gupta. *
B. L. Udhalikar'
G. L. Chandore
G. M. Bawsay.
M. S. Nair.
M. D. Anadeo.
R. D. Mukerji.
R. S, Shiwalkar.
T. J. John.
T. N. Puranik.

Third Division.

D. Chandrayya.
D. R. Soman.
D. P. Sharma.
K. G. Wadnerkar.
N. V. Bapat.
S. G. P. Tiwari.
S. M. Ali.

Pass.

Lal Har Narayan Singh.
U. G. Deshpande.
W. R. Deshpande,
B. S. Venugopal Rao.
Haribansa Misra.

* Awarded the Sir Arthur Blennerhasset Memorial Medal for standing first at the B. Ag. Examination of 1935.

INTERMEDIATE EXAMINATION IN AGRICULTURE.

First Division.

W. B. Date.*
M. K. Reddy.
M. G. Kamkolkar.

Second Division.

B. L. Choudhari.
G. K. Bhake.
G. S. Bhagwat.
M. S. Kiledar.
M. A. Kolkhede.
T. N. Supe.
B. P. Upadhyaya.
G. R. Yadav.
G. R. Shembekar.
Mohammed Shoaib.
P. M. Shrivastava.
V. G. Deodhar.
V. S. Kulkarni.

* Awarded the Sir Arthur Blennerhasset Memorial Medal for standing first in the Intermediate (Agriculture) Examination of 1936.

Third Division.

G. V. Dhoke.

V. S. Saoji.

P. R. Roday.

Pass.

M. Kesava Das.
P. V. Bapat.
S. Kasim Husain.
P. Harinkhere.
S. P. Pimplikar.
N. T. Saoji.
R. K. Wadaskar.
W. S. Vyawahare.
R. D. Joshi.
T. M. Koyal.

Compartmental.

G. P. Deshpande.

Hridayananda Das.

THIRD YEAR PROMOTION EXAMINATION.

Successful Candidates in order of merit.

1. J. L. Sen.
2. S. Kuffalikar.
3. H. N. Mukerji.
4. V. S. Dehadrai.
5. A. B. Mitra.
6. S. P. Pimplikar.
7. K. U. Tathode.
8. T. M. Koyal.
9. Mohd : Luqman.
10. V. N. Andhare.
11. Gajraj Singh.
12. R. D. Joshi.
13. D. P. Persai.
14. B. V. Bhatt.
15. N. V. Bapat.
16. Mohd : Nasiruddin.
17. V. T. Tanksale.
18. M. P. Kashyap.
19. K. R. P. Nair.
20. P. Harinkhere.
21. M. K. Deoskar.

FIRST YEAR PROMOTION EXAMINATION.

Successful Candidates in order of merit.

1. D. V. Dakshnidas.
2. M. V. Gokhale.
3. S. S. Tomar.
4. M. C. Gangrade.
5. D. C. Jain.
6. Hajarilal Nema.
7. B. G. Ghawghawe.
8. R. K. Shukla.
9. Ramchandra Kurmi.
10. M. D. Patil.
11. D. R. Vaidya.
12. N. Y. Karkarey.
13. D. R. Yadava.
14. N. B. Gupta.
15. G. R. Tatwawadi.
16. B. T. Wankhade.
17. R. S. Kachwsha.
18. H. N. Soni.
19. C. M. Kekre.
20. H. S. Thakur.
21. C. B. S. Saigal.
22. B. S. Shukla.

23. M. R. Banapurkar.
24. B. Shankar Rao.
25. D. V. Narayan Rao
26. L. P. Shashi.
27. V. P. Avadhoot.
28. S. G. Deshmukh.
29. P. N. Pate.
30. N. D. Dalal.
31. K. A. Bhandarkar.
32. D. P. Tiwari.
33. S. P Chitnavis.
34. V. D. Deshpande.
35. G. D. Dalal.
36. Mohd. Ibrahim.
37. M. W. Khankhoje.
38. Y. R. Saoji.

RITCHIE SILVER MEDALS

FOR BEST TWO ESSAYS

ON

THE IMPORTANCE OF FRUIT AS DIET AND AS A CROP

OPEN TO THE STUDENTS OF AGRICULTURAL COLLEGES AND SCHOOLS.

JUDGING COMMITTEE:

J. H. RITCHIE, ESQ., M.A., B.SC., I.A.S.,

Director of Agriculture, U. P.

T. R. LOW, ESQ., B.SC., I.A.S.,

Principal, Agricultural College, Cawnpore.

Essays in English to be submitted by the 31st July, 1936, to T. R. Low, Esq., Principal, Agricultural College, Cawnpore.

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THE LATE Dr. F. J. F. SHAW.

It is with a deep sense of personal loss that the writer of this note pens these few lines in appreciation of the late Dr. F. J. F. Shaw, D. Sc., C. I. E., I. A. S.

Fredrick John Freshwater Shaw first came out to India in February 1910 as Supernumerary Mycologist at Pusa. Within a short time of his arrival it was evident that young Shaw was a great asset to Pusa, and he won the affection and esteem of the whole staff. His popularity was well deserved; in the laboratory he made his mark because of his intelligence, his wide knowledge of Botany, his eagerness to impart this knowledge to those who worked with him, his genuine appreciation of the work of his juniors and of their aspirations and ambitions. Outside the laboratory his popularity was due to his tact, amiability and sportsmanship; he could always be relied upon to play the game.

When Dr. Shaw was appointed Imperial Economic Botanist to succeed the then Mr. (now Sir) A. Howard, the Mycological Section at Pusa suffered an irreparable loss; but what mycology lost economic botany gained. It was not long before he made his presence felt in the field of economic botany. His work, both in mycology and botany, bears the impress of a careful, accurate

and painstaking scientist; he was never flashy, never hasty in drawing conclusion. Dr. Shaw was invariably a pillar of strength to those who worked with him; he evinced considerable pride in his section and in those with whom he worked. He was never more happy than when success came to his collegues and assistants. As Director of Pusa, Dr. Shaw established his claims as an administrator of high repute; he had considerable breadth of vision; he was firm, but just and kind; there was nothing petty about him. At Pusa, during the last decade no section was more popular to the post graduate students than the Botanical Section. This was due to Dr. Shaw who took a personal interest in his students; he spared no time or trouble to give his best to them. His keen and practical interest in them did not cease when they left Pusa but followed them; many of them today are well established because of their *guru* and friend.

The tragedy of his early death is that Dr. Shaw for the last few years was ceaselessly active, single minded and assiduous to effect a successful transfer of Pusa to New Delhi, and to revive at New Delhi the old glory of the Central Research Institute. Just when the transfer was about to be successfully completed, and just as he was about to set out on the second part of his task, the revival at New Delhi of Pusa's past glory, Death has removed him from the field of his activities. Peace be to his soul!

Dr. Shaw's death is a loss not merely to Pusa, or New Delhi, but is a loss to Indian agriculture, loss to his friends, loss to his students.—J. F. D.

CURRENT SCIENCE

We offer our felicitation to Current Science on the completion of the fourth year of its existence. During the last four years this journal has played a very important part in the progress of

scientific research in India by serving as a medium for giving publicity to the research of scientific workers. Although research in India has in recent times been making amazingly rapid strides, it is still in its infancy and in its future growth and development Current Science will have a very important roll to fill. The success of the journal in fulfilling this roll will depend largely upon the support which it would receive from the public in general and scientific institutions in particular. We trust that this extremely useful journal will receive unstinted support from all interested in the progress of scientific research in India.—Ed.

Original Articles

SEED UNIONS

By D. R. Moharikar,

Deputy Director of Agriculture, Raipur.

Seed Unions are institutions designed to encourage thrift, self-help and mutual co-operation in villagers. The main underlying idea is based on the principle of effecting some saving when the cultivator reaps his harvest, and incurs a lot of expenditure. He makes all his purchases of cloth and other requirements at this period but never thinks of laying by any thing as savings which may be useful to him in times of need. In fact he has no facility for this in villages. Seed Unions supply this want. Grain is the currency generally used in villages for making payments for work done and most of the purchases are also made on barter. Seed Unions serve as grain banks where the cultivator can deposit a part of his income in kind at the time of harvest. Ten or more cultivators join together to start a Seed Union. The yearly contribution which each makes to build up the stock, depends on the area cultivated by each or on the number of ploughs he works to cultivate his area. This may vary according to season. The stock is administered by

panchas, who are elected in a general meeting of the subscribers. This gives them a chance of mutual co-operation. Any member is entitled to borrow grain from the union stock to a limit fixed for each by the panchayat, and this depends on the paying capacity of the cultivator. Each member is expected to pay back the stock with interest thereon at the time of harvest. The beginning is generally small but its usefulness is gradually realised as the stock increases year by year without any undue strain on the members. The members get several chances to meet together to discuss the affairs of the union and this creates a common bond and they begin to feel that they have something in common amongst themselves. Regularity of payment enhances the credit of the member and he is generally respected. This gives an impetus to others as well. Mutual co-operation, thus infuses in them a spirit which tends to make them honest and helpful to one another. In most of the villages, one comes across persons who have made grain lending business their main profession and the cultivators have lost very heavily thereby. In many cases the rate of *barhi* is even now 50% of the original advance, 25% being most common. When a needy cultivator approaches the grain lender for any advance he may not get it in time. Short measures are used and the grain advanced is also not pure and clean. At the time of repayment, however, the correct measures will be used and pure and clean stuff will be demanded. The cultivator is thus a loser in both ways. To save him from this loss the organisation of a Seed Union is the best remedy. It demands great patience on the part of the organiser, as generally cultivators take some time to realize the advantages but once this stage is reached, it requires but little looking after.

The Indian cultivator by usage is accustomed to part with a fair percentage of his harvest at the time of threshing to beggers who swarm at this period. This goes under the name of charity. A study of the methods followed by professional beggars in exacting payments from the cultivators, makes one think, whether this can at all be called charity. In former times when a beggar was either a real ascetic or an incapacitated person such charity was well deserved and this could even now be kept up, but if the stock now mis-applied under the name of charity could only be diverted to build up the stocks of a Seed Union in each village, it will provide adequate funds to carry on any village uplift work and will help the cultivators in improving their lot.

Once the stock exceeds the *barhi* requirement of the villagers, it can be utilized in several ways to increase the production and earnings of the members. Such organised unions provide good examples of how the cultivators can help themselves or in other words, self-help. A short history of a Seed Union through which the members worked up their way should not be out of place to illustrate this.

The village of Baghmarra is situated in Balod Tahsil, District Drug, in C. P. In 1926 when work was taken up in this village, the cultivators used to take grain on *barhi* from a Marwadi who had settled down in the village. The requirements were nearly abont 200 khandies of paddy (1 Khandi-140 lbs), and this was taken on 50% barhi. A cultivator borrowing 10 khandies had to pay back in 6 months 15 khandies. An effort was made to start a Seed Union in this village to save the cultivators from this loss and they agreed to form one. In the year 1926-27, 34 cutltivators joined and contributed 34 khandies of paddy each member subscribing one khandi. The following year this quantity was issued on *barhi* @ 25% and fetched 3½ khandies of paddy, thus increasing the stock to 42½ khandies and with the new contributions of members for the 2nd year the stock rose to 76 khandies at the beginning of the next year. The following table shows the progress from year to year.

Year.	Stock at the beginning of the year.	Number of members.
1926-27	34 Khandies	34
1927-28	76¼ ,,	40
1928-29	87 ,,	38
1929-30	113 ,,	38
1930-31	141 ,,	38
1931-32	168 ,,	38
1932-33	209 ,,	40
1933-34	236 ,,	42
1934-35	263 ,,	42
1935-36	324 ,,	42

The business transacted in different years is given below:—

Year.	Seed advance given.	Barhi earned.
1926-27	34 Khandies	8½ Khandies
1927-28	76 ,,	19 ,,
1928-29	87½ ,,	21.7/3 ,,
1929-30	113 ,,	28¼ ,,
1930-31	106 ,,	26½ ,,
1931-32	76 ,,	19 ,,
1932-33	168 ,,	42 ,,
1933-34	108 ,,	27 ,,
1934-35	243½ ,,	60¾ ,,
1935 36	198½ ,,	49 ,,
		Total 302 3/8 Khandies.

This shows that the earnings from *barhi* alone for the Seed Union during the period were nearly 302 khandies of paddy and an equal quantity was saved as the *barhi* was 25% against the 50% in the tract. The Co-operative dealings of the members now numbering 42, enabled them to have sufficient stock for their own needs and now this is jointly owned by the members. The result of this has been complete discomfiture of the grain lender who is now prepared to advance at a very low rate, but the members have realized the loss they would sustain by borrowing from him. The cultivators from surrounding villages have also been benefitted as the *barhi* rate has now gone down from 50% to 25%. This is only one aspect of the work. The other and more important is the fostering of co-operative spirit which was evinced when the members decided to have a godown for the Seed Union. This was erected in May in the year 1932 by contributions from the members who subscribed the bamboos, wood and tiles required, and labour from all was free. The godown provides two sufficiently big compartments for storing paddy and a verandah where all members meet in the evening. Spirit of mutual co-operation once assimilated, stimulates further action. The ease, with which they could build the godown, encouraged them to remove another deficiency of the village, namely well. Tank water was so far used by all but now they decided to have a well. Well-to-do members promised to contribute in cash, the amount required for purchasing from outside, such materials as cement, stones, wood etc, and for payment to masons, others undertook free carting of some material and the poor contributed in the shape

of labour for digging and constructing the well. The part which each shared was related to the position each had in the village. The well-to-do members shared more expenses which was just in the fitness of things. In any scheme of real village uplift, each individual is expected to contribute according to his position for the benefit of his less favoured brethern. The well which is estimated to cost Rs. 450/- was thus got ready in no time at a cost of Rs. 130/- in cash while the remainder, represents value of labour etc. contributed by the village, preparation of urine earth manure, use of improved seed an improvement in the case of animals also made gradual progress, The increasing transactions required careful watch and to give it a permanancy, the union was registered in the year 1933 under the Co operative Credit Societies Act. New crops such as groundnut and cane were introduced in the year 1932-33 and the table below shows the progress made from year to year.

Area under new crops.

Year.	Groundnut.	Sugarcane.
1932-33	17 acres	0.37 acres.
1933-34	34 „	0.50 „
1934-35	52 „	7.82 „
1235-36	84 „	18.00 „
1936-37	100 „	37.00 „

Consolidation of holdings was carried out in the year 1931 and its advantages were soon realised. Planting of fruit trees such as mangoes, guavas, plantains, lemons and oranges were also started on a small scale in 1932 and progress in this direction was also maintained. In the year 1934 a village panchayat was also established. In the same year the members of the Seed Union proposed that further contributions to the Seed Union should be stopped. They were however advised to contribute and increase their stock so that co-operative farming may be started and a begining was at once made in that direction. An area of 7.25 acres was taken on lease in the year 1934-35 and 6 acres in 1935-36. The cropping for the two years was as follows;—

	Year 1934-35	Year 1935-37
Sugar cane	2-75 acres	3.00 acres
paddy	2.50 ,,	2.00 ,,
Groundnut	1.50 ,,	1.00 ,,
Rahar	.50 ,,	—

The first year's working gave a net profit of Rs 290/. while the 2nd year yielded Rs. 253/-. Great difficulty was experienced in securing land on lease. The members therefore decided to utilize the profits earned in purchasing land and digging a well. A piece of 7 acres, suitable for planting sugarcane and for an orchard has now been acquired for the union and the planting of orchard has been started.

Co-operative cultivation is financed by the members borrowing grain from the union and this grain is earned back in the shape of wages by the poorer members of the union, who also share in the profits. It thus provides occupation in slack season to those, who can not independently carry out any garden cultivation. One of the members whose holding is situated close to the union's plot has now also dug a well and planted an orchard. Two more members intend digging their own wells to plant systematic orchards for which a taste has now been created.

The introduction of new crops at the lowest computation has enabled the cultivators of this village to lay by at least Rs. 1.500/- in the year 1934-35 and another Rs. 3,000/- in 1935-36, and with the increase in area under cane and groundnut, the earnings will gradually increase.

Mrs. Seamon's scheme of affording relief for minor ailments has also been introduced and a local woman was trained in the Balod Hospital to to administer the medicines stored in the village. The local cultivators are now very hopeful and the success so far achieved is encouraging them to further action. The effect of this improvement has stirred the cultivators of the surrounding villages also who have now started forming Seed Unions, and cane cultivation has been taken up in 5 villages.

The results as stated above are the out-come of the patient working for the last ten years and show the way how villagers could improve their lot by joint action, and stand on their own legs by self-help.

THE CULTIVATION, CURING AND MARKETING OF CIGARETTE TYPES OF TOBACCO IN THE GUNTUR DISTRICT.

By B. S. Rao, L., Ag. (Hon.).

The Imperial Council of Agricultural Research, India, has suggested to the various Provinces and some of the Indian States to conduct experiments with regard to the cultivation and flue-curing of cigarette types of tobacco. If the climatic and soil condition of the various provinces will allow the proper growth and successful curing of the leaves of cigarette types of tobacco and if the finished product will possess the qualities required by the trade, then it may be profitable to grow them in view of the preference given in the United Kingdom to Empire grown tobacco. It is the cigarette type of tobacco that is chiefly required as the use of cigarette is increasing all over the world.

As the cigarette type of tobacco is grown on a large scale in the Guntur District, I visited the locality in January 1936 so that I may get an insight into the methods of cultivation, curing and marketing. The present article is an outcome of that visit. On reaching Guntur the first place I could think of visiting was the Government Central farm at Lam near Guntur. But it was a great surprise to me to find that this farm, situated in a District which was famous for the cultivation and curing of cigarette tobacco had no barns for flue curing of tobacco. I was told that the tobacco grown on the farm was all sun cured.

The Indian Leaf Tobacco Development Co., Calcutta has been responsible for the introduction of the Virginian Types of cigarette tobaccos in the district 15 years ago. The area under cigarette types in the district is estimated to be over 40,000 acres at present. Cultivation of cigarette tobacco has been tried and found successful in the Lankas (Islands) of the deltas of the Krishna and the Godavari. Consequently its cultivation is extending in the Krishna and Godavari districts. Most of the tobacco grown in the district-about a crore of rupees worth annually, is being purchased by the Imperial Tobacco Co., by merchants from Japan, and other commercial agents.

The two factors that have particularly favoured the cultivation and curing of cigarette types of tobacco in the Guntur District, are, firstly, a soil which is very retentive of moisture, and secondly, the prevalence of a moisture-laden sea-breeze during the later portion of the crops' growth and during the curing season. This breeze starts in January and blows till

the end of March. Fortunately for Guntur the district is spared from the visitations of hail and frost which ruin the crop in many other parts of India.

The average yearly rainfall of the Guntur District is 30 inches. The District gets the benefit of two monsoons. From May to July the S. W. Monsoons contribute about 18 inches. Then there is a break till October. The N. E. Monsoon which does not extend over a long period but is heavier in concentration, contributes about 12 inches during October. The success of the tobacco crop in any particular year depends upon the nature of the N. E. Monsoon. Provided the amount is sufficiently heavy the soil which is very retentive will support a tobacco crop without the necessity for irrigation. Irrigation after the plants have established, is found to ruin the quality of the leaves. Hence the crop is always grown as a dry crop. Cigarette tobacco is cultivated on two kinds of soil in the Guntur District.

(1) Low lying, silt lands along the Krishna River. These are known as the *badua* lands. The following villages, i. e. Errapalyam, Tadikonda, Mandadam, Kristaya Palayam, Nirukonda, and Parimi, are the chief cigarette tobacco growing centres possessing the above soil. Before the introduction of cigarette types of tobacco only paddy as a dry crop used to be grown. The leaves of tobacco from these areas are noted for their size, colour, and easy curing. But the cured leaves do not retain the golden colour which is so highly valued. Investigations are being started to find out the causes for this unfortunate drawback.

(2) Black loamy soils and clay soils. Villages which possess such soils and which are noted for their cigarette types are Ananthavarappadu, Bonthapadu, Etukur, Lalipuram, and Pedda Kakani. On these lands, the outturn, size, and curing quality of the leaves are not as good as on the *badua* lands. But the cured leaves retain their colour properly.

The tobacco crop has been found to suffer if proper rotation is not followed. In the *badua* tract tobacco crop is taken during alternate years. One year they take either paddy or jouar, and the second year they grow tobacco. On the loamy and clay soils. during the first year they take two crops, groundnut as a S. W. Monsoon crop and Jola as a N. E. Monsoon crop. The following year tobacco is taken.

Soils in the District are rich and hence no manuring is done during the years tobacco is grown. The quality of tobacco on manured lands has been found to be inferior. A light colour of the leaves is what is desired

even when the plants are green. This quality is generally not found when manure has been added.

A feature of the tobacco growing area is the large number of shallow ponds which have been prepared below the slopes to catch the rain water and the surface flow water. It is only the water in these ponds known as "*Kuntas*" that is used for watering the nursery beds and at the time of transplanting the seedlings on the field. Well water is rarely sweet and the brackish water is never used for watering even the young tobacco plants as it seriously affects the burning quality of the leaf. As already pointed out the crop is not irrigated.

The chief type of cigarette tobacco that is grown is the Harrisons Special. Adcock is grown on a very limited area. The former gives higher yields, and its leaves retain the colour for a longer time after being cured. Nursery beds which are raised 6 inches above the ground level are carefully prepared. They are 4½ ft. broad. A nursery 45 ft. long and of the above width will be able to supply seedlings for 1 acre. Trash is burnt on the surface to sterilize the soil. Sometimes slaked lime is used for disinfecting the soil. Cattle dung (@ 30 cartloads per acre and ashes are added. It has been found that seedlings which are fed with nitrogenous fertilizers develop into plants whose leaves are dark in colour. Watering is carefully done so that the bed may not remain too damp. If seedlings are seen dying in patches due to fungus attack bordeau mixture is sprayed. This checks the extension of the fungus attack very effectively. Sweet water from the shallow ponds (*Kuntas*) is used. Seeds are sown in the nursery from the end of July to the middle of September after intervals of a week. There are certain cultivators who grow seedlings for sale. Even the Indian Leaf Tobacco Development Company has arranged for the raising of seedlings at various centres and sells them to the Tobacco growers.

Seedlings are transplanted in the field when they are 1½ to 2 months old. Except a small quantity of water which is given by hand to each transplanted plant no more irrigation is given. The plants establish quite satisfactorily without any attention whatsoever. Distance between rows is 2½ ft. and a similar spacing is allowed between plants in a row. The number of plants in an acre is about 6,000.

A pernicious weed which is found in abundance on some fields is the root parasite Orbanche. As soon as the parasite appears above the ground it is removed and fed to cattle or burnt. It is not desirable that it

should be fed to cattle as the seeds are returned to the land along with the dung. This pest appears particularly on lands where tobacco is grown year after year. Due to this parasitic weed the tobacco plants are stunted in growth and present a sickly appearance. Fortunately for the Guntur cultivators their crop is not known to suffer from leaf curling disease the prevalence of which is a great handicap in some other parts of India.

Except when the plants are stunted in growth topping is not resorted to. Flowering is allowed to take place.

Leaves are considered to be fit for harvest when they assume a slightly yellowish tinge. Naturally the bottom leaves are harvested earlier. Nearly 20 leaves which are worth while being flue cured in a barn are obtained from each plant. These are plucked in 5 or 6 instalments. After half the number of leaves from the ground are harvested the plant is topped so that the remaining top leaves which are small may develop into bigger leaves. Harvesting is very carefully done to avoid injury to the leaves. Sometimes the labourers pluck immature leaves. These leaves do not cure properly in the barn. They do not turn into a lemon yellow but retain their green tinge. Cigarette types of tobacco are cured in the district by the following methods :—

(1) Sun curing.
(2) Shade curing.
(3) Flue curing.

Sun curing.—The leaves are closely strung on pieces of thread about 6 ft. long by means of a long flattened needle which is pierced through the midrib. These leaves on string are hung in the open with the ends of the strings tied to bamboo poles. As the leaves dry they are pushed closer and more green leaves added towards the ends. Care is taken to see that when it rains the strings are removed into sheds. The leaves are left in the open night and day for nearly 40 to 45 days. When the midrib is dry the strings are removed on a morning when the leaves are soft and elastic and the leaves are arranged into square heaps and properly covered with gunny sacks and kept under slight pressure. After a week the leaves are taken out, sorted, made into hanks and the hanks are again kept in heaps under pressure. The heaps are opened after about a week to prevent overheating due to fermentation. The hanks are again heaped, but in the second heaping those hanks which were in the bottom of the first heap are placed at the top of the second heap. Those which were at the top of the first heap are placed in the middle of the second heap and those which were in the middle of the first heap are placed at the bottom of the

second heap. The second heap is opened after 10 days of heaping. The hanks are then pressed into a bale.

The price obtained for sun cured leaves is very low as the final product has none of those desired qualities which are to be found in flue cured leaves.

Shade curing.—This resembles the sun curing process in every detail excepting that the strung leaves are dried under shade. The quality of the product obtained is superior to that from the sun curing process. The colour of the cured leaves will not be so dark as sun cured ones. The aroma is also more pleasing.

Flue curing.—In order to obtain the best quality of cured leaves for high class cigarette making the method by which the leaves are cured is as important as the type of tobacco grown. Types like the Adcock, Harrisons' Special and H-142 which are esteemed types and used in the manufacture of high class cigarettes are only so when properly cured under controlled conditions of temperature and humidity. These types when sun cured or shed cured are useful only for the cheapest brands of cigarettee sold in the market. Similarly the ordinary varieties of tobacco grown in India cannot be rendered useful for cigarette making even when cured under the best of regulated conditions of moisture and humidity as they do not possess those inherent qualities which are necessary for the making of a high class cigarette leaf. High class cigarette types therefore are cured by the flue curing process.

In the flue curing process the leaves are slung on bamboo sticks about 4 ft. long. On each stick there are nearly 30 leaves. The leaves are slung on either side of the stick in couplets with the back of one leaf against the back of the other. Such loaded sticks are placed in tiers in a specially constructed building known as the "barn". The barn is completely air tight. There are certain ventilators placed at the top of the building and at the bottom which can be closed or opened according to the quantity of air that has to be let in during the different stages of curing. The curing is effected by heating the air inside the barn. This is done by allowing hot air to travel through a system of big pipes known as flues kept on the floor of the barn. Air is heated by feeding a furnace flushed in the wall outside the barn. The furnace is connected by a cast iron pipe with the flues inside. The hot air after passing through the flues inside the barn escapes through a chimney. The temperature inside the barn is regulated by controlling the fuel feed and

the inlet of cold air. The temperature inside the the barn is carefully watched by means of a thermometer which is known as the "Curometer". The curometer is attached to a string which runs over two pulleys, one in the centre of the barn and the other near a window provided with a glass shutter. The curometer which is used to record the temperature in the, the middle of the barn is brought to view near the glass window by operating the string which passes through a hole in the window chowkat.

The barns used in the Guntur District are of two types (a) single barns (b) double barns. The double barns are the more commonly found. They are 20 ft. long 20 ft. broad and the height at the centre of the gabled roof is 29 ft. The walls are made of either brick in mud or mortar or rough stones in mud or mortor. The roof consists of corrugated sheets of iron. The centre of the gabled roof consists of a gabled cap suspended in a frame work. This gable can be raised to a height thus acting like a ventilator. When the air has to escape the gable is raised by pulling certain wires that run over pulleys. The double barn is provided with two furnaces or stoves The erection of a double barn including flues and furnaces comes to about 1600 Rs. About 5000 lbs. of green leaves are arranged in the barn for each charge. Leaves are slung on either side of bamboo sticks 4 ft. 10 inches long. The number of leaves, if only 2 leaves back to back are included in a loop, as is desirable will be about 40. But in many cases 3 leaves are inserted in each twist. This spoils the quality of the cured leaf. The loaded sticks are placed on tiers, the vertical distance between which is 2 ft. In a double barn nearly 1100 sticks are accommodated. The cured product obtained is about 1000 lbs. per charge. A double barn can deal with the produce of 5—6 acres if the crop is good in a season. If the crop is poor then it can deal with the produce from as many as 10—15 acres. The time taken to cure each charge is nearly 4½ days. The cured leaves are heaped and sorted and bulked as explained under air curing. As the process of flue curing is a specialized art there are persons who have specialized in curing and earn a living as curers.

In the process of flue curing the following stages are carefully watched.—

I Stage.—Yellowing stage. The door and the ventilators, are all completely closed. If humidity is not high water is sprinkled on the floor of the barn. Starting temperature in the room is 85°. Gradually raised to 100° within 24 to 36 hours according to the quality of leaves.

The yellowing takes place earlier if the harvested leaves are mature. If immature leaves are loaded then the rise in temperature will have to be slow and a longer time taken.

II Stage.—Colour fixing stage. Temperature is gradually raised from 100° to 120°. The roof ventilator is opened 1/3 at 105° and gradually opened till it is competely open at 110°. Bottom ventilators are slightly opened at 110° and gradually lifted till at 120° they are completely open. Time taken is from 16 to 24 hours.

III Stage.—Midrib drying stage—from 120° to 165°. Roof ventilator left completely open. The bottom ventilators are now gradually closed and at 150° they are completely closed. The rise of temperature is one degree per hour. The temperature of 165° is maintained till the midrib is perfectly dry. If the midrib is not throughly dried then the moisture spreads to the other portions of the leaf and causes rotting. The time taken depends on the thickness of the midribs. Usually it takes about 50 to 60 hours.

The following temperature charts have been taken from the registers which were maintained by a reliable cultivator who owns barns and cures the leaves very successfully. As the thermometers that are used are graduated to indicate a rise of 5° per graduation the rise in temperature is generally by 5° at every change affected by the curer.

Load A		*Load* B	
Room temperature 85°		Room temperature 85°	
90— 1 to 21	hours.	90— 1 to 27	hours.
95—22— 30	,,	95—28— 38	,,
100—31— 36	,,	100—39— 41	,,
105—37— 38	,,	105—42— 45	,,
110—39— 40	,,	110—46— 48	,,
115—41— 42	,,	115—49— 51	,,
120—43— 47	,,	120—52— 57	,,
125—48— 53	,,	125—58— 62	,,
130—54— 59	,,	130—63— 67	,,
135—60— 65	,,	135—68— 73	,,
140—66— 70	,,	140—74— 79	,,
145—71— 79	,,	145—80 86	,,
150—80— 82	,,	150—87— 90	,,
155—83— 88	,,	155—91— 95	,,
160—89— 94	,,	160—96—102	,,
165—95— 106	,,	165-103—106	,,

It is not to be supposed that all those who grow tobacco also possess their own barns to cure their leaves. Some cultivators grow the crop and also possess their own barns. Some cultivators take their leaves to barns which could be hired and do the curing themselves provided they know the art. Some culivators take the leaves and get them cured in barns which are hired by specialised curers. Some cultivators grow the crop and sell the leaves to merchants who cure them. Either the entire crop is sold or only selected leaves. An entire crop may fetch from Rs. 30 to Rs. 130 according to the quality of the crop. When only selected leaves are sold the rate varies from Rs. 12 to 15 for 500 lbs. of green leaves. The cultivators cure the rejected leaves by the sun curing or the air curing methods. One thing to be remembered is that it is useless to think of curing bad leaves in a barn. It does not pay. It is not always that a barn is near the standing crop. Hervested leaves are carefully arranged in bullock carts and sent to distances of 12 to 15 miles. But such leaves are said to suffer in quality during the transit.

The cost of growing an acre of tobacco is estimated at Rs. 60 per acre. The lands are generally leased and the lease rent is very bigh *i. e.* Rs. 25 per acre. The cultivator estimates his expenses as follows :—

	Rs.
Lease rent	25—0—0 to 30—0—0
Seedlings and planting	10—0—0
Cultural operations.	18—0—0 to 20—0—0
Total. ...	60—0—0

An average yield of cured leaves per acre is 2 candies or 1000 lbs. A good crop yields 2½ to 3 candies of cured leaves. A candy weighs 500 lbs.

When the barns are hired for curing the owners of the barn charge Rs. 30 per load or charge. The owner of a barn easily earns from the rent obtained Rs. 200 to 300 per season as a barn is filled at least 12 to 15 times during the season. Construction of tobacco barns is a good investment in the Guntur District. When the cultivator has to depend on a curer to cure his leaves the rate charged varies from 60 to 80 Rs. per load including the hire of the barn, the cost of fuel, the labour employed for stringing loading, supervisor etc. A rough analysis is as follows ;—

Labour	10—0—0 to 15—0—0
Fuel ton.	10—0—0 to 15—0—0
Supervisor and fireman @ Rs. 40 and Rs. 15 per mensem respectively	10—0—0 to 15—0—0
Hire of barn.	30—0—0 to 40—0—0

In their anxiety to fill as much as possible in a barn the parties that own the leaves overload the barn with the result that the quality of the final product is inferior. The party that cures on contract is interested in drying the leaves as quickly as possible to economise fuel and labour. This hurry also causes the leaves to retain their green colour instead of curing to a golden colour. The best quality of cured leaves are obtained when the barn, the management, and the leaves are all under one individual's control.

The cured leaf is sold to the tobacco merchants either after the leaves are graded or before. The rate per candy of ungraded leaves varies from Rs. 130 to 160. The graded leaves fetch different rates according to the quality. The Indian Leaf Tobacco Development Company who are the chief purchasers of the cigarette types grown in the district have the following grades according to the size and colour of the leaves.

The following table shows (1) the grades into which the Indian Leaf Tobacco Development Company classify the cured leaves which they purchase for export to the United Kingdom (2) the price per pound of leaf (3) the rate per candy and (4) the percentage by weight which each grade forms out of the total weight of leaf purchased by the Company.

Grade.	price per lb. (1936) Rs. a. p.	Rate per candy of 500 lbs. (1936) Rs.	% by weight to the total quantity purchased by the I. L. T. D. Co.
I	0 9 0	250 to 300	15 %
II	0 7 0	180 to 240	
III	0 5 0	80 to 180	60 %
IV	0 4 0	100 to 180	
V	0 2 6	50 to 75	10 %
IV	0 1 6	30 to 45	15 %

The above table makes two points clear (a) that harvesting and curing should be carefully done to get as far as possible higher grades of cured leaf. Due to any cause if the quality obtained is inferior then the

person to whom the leaves belong loses heavily. Care is therefore to be taken at every stages to ensure success.

Hanks of tobacco are pressed into bales just as cotton is; but the pressure applied is not great. The bales of tobacco have the following dimension : 48" X 18" X 18". Each bale weighs 250 lbs. Next to the tobacco we find a sindhi palm mat and over this gunny cloth are used and fastened with ropes. The baling charge amounts to Re. 1 per bale.

The rates obtained for the different kinds of tobacco in the Guntur market are as follows.

Flue cured tobacco Rs. 280 per candy of 500 lbs. leaves.

Barn chura (broken pieces of flue cured leaves) Rs. 20 to 30.

(Barn chura is used for manufacture of Bidies)

Gulla (harvested leaves which are not fit for being cured in the barn as being either too old, or two green are simply dried in the sun) Rs. 5 to 10 per candy.

Sun cured cigarette types—Rs. 40—45 per candy.

Shade cured cigarette types—Rs. 45—50 per candy.

Deshi Tobacco known as *natu tombacco* Rs. 60—65 per candy.

Natu leaves are used for smoking in the chelum, for manufacture of country cigars and cherra. It is not used for the manufacture of bidis.

THE IMPROVEMENT OF CATTLE AND DAIRYING IN VILLAGES WITH SPECIAL REFERENCE TO CENTRAL PROVINCES

By S. K. Misra, L. Ag.

The need for the improvement of cattle in this country is great as His Excellency the Viceroy pointed out, while presenting three pedigree bulls to Delhi Province. "The cow and the working bullock have on their patient back the whole structure of the Indian agriculture." To achieve the improvement early co-operation of private enterprise is very necessary without which it is impossible to go ahead with greater speed. To accelerate the improvement of the cattle, the rural cattle owner must be made to realise the money value of milk, and the profits from the milk industry must be secured for him.

Under the present conditions of the villages, the best methods to achieve success in the promotion of the cattle and the diary-industry consist in organising co-operative cattle improvement societies and in developing co-operative village diary factories. In all countries like

Denmark, Holland, Ireland, New Zealand, the United States of America and Canada, where dairying has reached an advanced stage, the cattle have been improved to a very great extent through co-operation, and the co-operative village dairy has been utilized as the means of manufacturing, and marketing the milk produced by the cattle owners. The work on this principle may be started in the villages of this country on the following lines:—

All the cattle owners of a village should form a co-operative cattle improvement society under the aegis of the Co-operative Department, each cattle owner taking shares in this society of say a few annas per head of bovine stock of all ages belonging to him or her. This co-operative society should be controlled by a small executive committee of say 6 or 8 persons elected by the share-holders on the principle of one member one vote. This executive committee should elect a chairman an honorary secretary and an honorary treasurer.

The society should be guided by expert advice in regard to finance, records and technical matters such as cattle breeding, feeding management including cattle diseases. It should therefore be under the supervision of the local co-operative department as regards its organisation, finance, accounts and audit and it shoud be advised and assisted by the local agricultural and veterinary department. All its records and accounts should be kept in the vernacular of the district.

The society should start its activities in the following order:—

1. A survey of all the cattle should be made and information should be recorded as indicated below:—

Name of the cattle.

Serial No. of the animal,

Class of animal (cow buffalo etc.)

Approximate age.

Number marked on the body. Approximate milk yield in a lactation in case of milch cattle.	The entries in these columns may be made at a later stage.

Remarks regarding breed etc.

2. Each animal should be marked with a number indicating the ownership of the animal. Any suitable method may be used for marking.

3. Suitable stud-bulls should be procured through the agency, or with the approval of, the local Agricultural Department. One stud bull would be necessary for every 50 adult cows.

4. Arrangements for the housing, feeding and supervision of the stud bulls should be made according to the instructions of the local agricultural Department.

5. A careful record of all the servings of each of these bulls should be kept.

6. A public notice should be issued that the bulls were available for service to members of the society free, and considered desirable, to a limited number of non-members from outside areas at a fee.

In Central Provinces and Berar, suitable bulls can be procured according to the 'Premium-bull scheme' from the Agricultural Department. The department is also rendering valuable help by establishing controlled breeding areas. Under this latter scheme, the bulls can be had free of charge by such organised societies.

7. Arrangement should be made with the help of the local Veterinary Department for the castration of all male stock in the village with the exception of say one specially selected bull per 50 cows or buffalos as a reserve for stud purposes. These reserve bulls if approved by the local Agricultural department, may be purchased by the society from their owners, and housed and fed along with the stud bulls referred to above.

8. Stud bulls should be changed from time to time in accordance with the advice of the Agricultural Department to avoid in-an-in breeding.

9. In consultation with the local Agricultural Department a scheme for the growing, and storing of fodder sufficient for the cattle of all members on a co-operative basis should be drawn up. Arragements to obtain cheap grass-reserves should also be made.

10. Arrangements should be made to record the milk yield of the best cows and buffalos belonging to the members of the society,

11. Wherever sufficient milk is produced, a co-operative dairy factory should be started. The co-operative societies of several surrounding villages may join together to run a dairy factory. Such dairy factories need not be expensive or elaborate. The equipment of the factories would depend on the amount of milk available, milk-products to be manufactured and the distance from the market. These factors

would be useful as they secure the maximum profits from the milk industry for the milk producer. Milk is a perishable article and its conversion into storable products is such a highly technical matter that the small producer cannot deal with the small quantities he produces. In a co-operative dairy factory, a number of small producers can join together and get higher profits by better handling of the milk for urban consumption and by practising improved methods in the manufacture of milk products without wastage.

12. To get trained hands, the society should arrange to get suitable members of the society trained in practical dairying and animal husbandry. The Agricultural Department C. P. has arranged to give such training through a short course in vernacular. The training is very useful and is not expensive.

The raising of the necessary capital in connection with the cattle improvement society or dairy factory should not be a difficult matter as the Central Cooperative Bank would probably advance the sum required, on the joint security of the members of the executive committee.

To meet the yearly recurring expenditure in connection with the cattle improvement scheme, the society might ask the Agricultural or Co-operative Department or the District Council for a yearly grant equal to the amount which it would itself collect. This could be done partly by asking for subscriptions from public spirited citizens and partly by collecting from its members a cess of a few annas per bovine head per month. The big cattle owners and the organised Gorakshana Sabhas can independently start the work of cattle improvements and dairying on the the above lines. If an honest effort is made, the value of cattle and the yield of milk could be doubled in about 10 years.

Extracts

AMERICA AND THE COTTON POSITION*

Thirty million Americans, occupying a territory comprising one-fifth of the United States, are faced to-day with a life and death problem. It is cotton. The present crisis is the logical outcome of the unwitting co operation between ignorant political rulers, inefficient agricultural leaders and highly competent cotton engineers. Unless the problem is solved, and speedily, the Americans will witness within the next decade the complete economic annihilation of the Southern States

America's Position in cotton Market.—Domination by the United States of the world's cotton market is a thing of the past. The monopoly enjoyed by American growers since the days of Thomas Jefferson is ended. Within the span of a few years, the tide has turned; the world is ceasing to pay the American people tribute. While the wizards in Washington have been pegging the price of cotton well above the world level and furthering campaigns to plow under and reduce the volume and acreage of American crops, the dominant importing countries abroad have turned elsewhere for their supply. The steady inroads, which foreign planters have made upon these markets, long considered exclusively American, promise to accelerate in the near future. The lack of an adequate supply of hand labour to pick the cotton has been, perhaps, the greatest deterrent to an even more spectacular rise of foreign production. But this handicap has now been negated by the invention of a successful cotton picking machine. As a result, overwhelming competition will come from Egypt, India, China, Russia, Brazil, the Argentine and above all, Australia. Soon, dangerously soon for the Southern states,- the centre of gravity of the world's annual cotton supply will have shifted to the Antipodes.

The solution of this problem is vital to America. Unless both cotton planter and Federal and State Governments engage in a wide-spread and thorough-going campaign to utilize the latest technological equipment, as well as to re-shape and modernise the agricultural set up, economic disaster is inevitable. There is no use in moaning ever markets already lost. The best that can be hoped for is to stage a lengthy, but losing, fight to retain some small measure of the cotton kingdom within the confines of America. Hence America, and the South in particular, must immediately set about an immediate reconstruction of its agricultural life.

* By. Mr. Manek Lal H. Vakil, M. A., LL. B., F. R. Econ. S., F. S. S., *Industrial India*, August 1936.

The time for experiment has passed. It is as surely antiquated as the political bombast (sound doctrine at the time) of Senator Hammond of South Carolina who, in his famous speech of March 4th, 1858 said :—

"Would any sane nation make war on cotton? Without firing a gun, without drawing a sword, should they make war on us, we could bring the whole world to our feet. The South is perfectly competent to go on one, two or three years without planting a seed of cotton. What would happen if no cotton was furnished for three years? This is certain: England would topple headlong and carry the whole civilised world with her, save the South. No, you too do not dare to make war on cotton! No power on earth dares to make war on it! Cotton is King!".

Senator Hammond's colleagues cheered this triumphant prophacy lustily; in every town and hamlet of the South the ringing phrases were quoted again and again. The consciousness of an overwhelming monopoly-at that time the United States was producing approximately ninety per cent of the world's cotton crop-caused Southern planters and politicians to feel that the destiny of civilisation rested with them.

Effect of war on America's Position.—The war did come, but the world failed to topple in accordance with the Senator's predictions. Instead other countries, such as Egypt and India (and even Australia) under the stimulus of abnormally high prices increased their cotton fields many fold. To be sure, the South regained its hold upon the monopoly within a few years after the close of the Civil War, but never again was that monopoly so complete as it had been in the late fifties. For as the number of cotton producing countries constantly increased with the years, production and export volume in the United States registered a slow growth.

When the world war began, the cotton importing nations (exclusive of the United States) were consuming approximately sixty to per cent of the American crop. The tremendous demand for cotton during the period of the war sent prices soaring, which in turn stimulated the output in Asia, Africa and South America During the post-war decade, foreign production outspaced the American, while the total world consumption reached high. The determined struggle of the forty-seven foreign cotton producing countries to break the back of American monopoly neared its ob-jective during the 1924-25 season when, for the first time, the total acreage sown by these nations exceeded that of the United States; and by nearly 100,000 acres. Since the average yield per acre, however, was

higher in the American fields, American growers retained the lead in production but it had fallen from ninety to fifty-five per cent of the world total. From then on it was a nip and tuck battle.

And at this point the political busy-bodies blundered into the fray. Their contribution was to prove a death blow to the Southern States and godsend to foreign growers. For it is precisely during the past ten years that the American decrease has been the greatest; the following five-year table tells the sad story of American declining production:—

America's Decline.

World production of cotton in thousands of bales.

	United States.	Foreign.
1931-32	16,877	9,587
1932-33	12,961	10,652
1933-34	12,712	13,173
1934-35	9,576	13,029
1935-36*	11,378	13,984

*Latest Government estimate

Foreign production has increased since 1931 by nearly 4,500,000 bales, while American production has decreased by more than 5,000,000 Though still the greatest single producer, the United States finally lost its century long hold on the cotton monopoly in 1933-34 with the advent of the New Deal and the fumbling Brain Trusters.

No matter how provincial and narrow-minded American cotton planters may be, they know full well that their crop is one which, more than any other, has been dependent upon a world market. Since the days when Eli Whitneys cotton gin laid the basis for the Southern States' greatest industry, from sixty to eighty per cent of the crop has been shipped abroad. Prior to the World War the United States, in a very true sense actually paid its debts abroad with cotton. Year after year, the world paid tribute to the American cotton fields to the tune of more than five hundred million dollars. Great Britain alone, in the course of the past hundred years, has bought over ten billion dollars' worth of cotton from the United States.

The change in the annual volume of cotton consumed in the United States itself during the past twenty years has been slight, despite population increase. American mills use about 6,000,000 bales annually. But world consumption has grown steadily during this same period, rising from 10,939,000 in 1918 to an all-time high during 1933-34, when

19,624,000 bales were consumed. In no other basic commodity has there been such an increase during the same period. In fact, shrinking rather than expending markets have been characteristic of post-war economy. And yet, in the face of this favourable situation not only did the United States fail to register a substantial gain in cotton exports, but to the contrary allowed these new markets to be seized by others. The net effect of increased foreign production and decreased domestic production has brought about the drastic curtailment of American exports. They are literally melting away.

Germany,which normally purchases between 800,000 and 1,000,000 bales, bought only 376,000 in 1934; and according to W. A. Leonard, the American Consul at Bremen , purchases for the first seven months of 1935 amounted to only 160,000. Meanwhile German imports of Brazilian cotton soared from 12,540 pounds in 1933 to 99,022,440 pounds in the same period. Great Britain, Japan, France, Italy, Poland and Zechoslovakia the largest importing nations-have reduced their purchases from the United States and expanded them elsewhere. Brazil has tripled production within five years. China has doubled its volume in the same time Russia, where the crop was negligible from 1917 to 1925, has staged tremendous come-back five years ago it produced 1,843,000 bales, in 1935 its total yield exceeded 2,300,000. Mexico has doubled its acreage in the past three years, Every cotton growing country in the world is exerting intense efforts to increase production, that, is every country except the United States.

While foreign governments during 1934-35 season were subsidising growers, and cotton acreage was increasing by more than four million acres, Mr. Roosevalt's New Deal experts in Washington managed by law, by threats and by fines to compel a million American growers to plow under the amazing total of 15,000,000 acres of fertile land.

Reasons for her Decline.—One single factor has been responsible for the collapse of America's great cotton industry. Its name is politics. Nothing else can be reasonly blamed. There has never been any lack of land, no country in the world (except Australia) possesses such a vast contiguous areas highly suitable for cotton production. An adequate labour supply (heretofore a serious handicap in many countries) has never been a major problem in the United States. Not only have American planters been able to produce the much-needed labour supply during cotton picking seasons, but they have also been able to hire workers considerably more efficient than those of other nations, Researches

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made in fortyseven typical cotton countries during 1929, according to Professor J. T. Sanders Kklahoma A. and M. College, reveal that:—

"The average acres of cotton per agricultural worker in the Uuited States are about thirteen. In the south-West cotton growing area, the acreage runs much higher, sometimes averaging from whole counties as high as six to seven acres. In Seventeen representative cotton producing districts of India, the average area of cotton per agricultural worker is about 18 acres. In a representative province of China, it averages about 4. In the Turkestan area of Russia before the war, the average worker had charge of 7 acres of cotton. In eleven districts of Egypt, the latest available statistics indicate the area per worker is exactly that of the figure quoted for Russia. In Brazil the average acreage per man in twenty-one cotton districts was 2.4; while in Uganda the average worker took care of half acre."

Furthermore the good work done by the American Experimental agricultural stations has given the United States the highest yield per acre of any couutry except Egypt. India, which ranks near to the United States in volume of production, has the lowest. For over thirty years, it has averaged ninety-nine pounds per acre. China's out-put has been only slightly higher. But for the United States the average out-put has been over 190 pounds.

Still further, adequate means of transportation (so essential for bulky commodity), both from the field to the gins and from the gins to the textile centres of the world, have favoured American producers. It has always been possible to deliver cotton from Texas, Mississippi and Georgia to Liver Pool, Havre, Bremen or Yokohama for comparatively low costs. To this day, backward transportation facilities remain a decided handicap to India, China, Russia, most of Africa and parts of Brazil.

America has thus had the benefit of many distinct advantages over competing countries. Accordingly, the reason for the present debacle can be found only in the fact, unfortunately too true, that inept American political leaders, by short sightedness and sheer stupidity, have done their utmost to cut off foreign markets from American growers, while foreign governments have eagerly taken advantage of the situation to increase their crops to the limit. Yet the fact that politics and economics are more closely intertwined to-day than ever before is still not understood by the sophomoric statesmen now entrenched by the potomac. Back-slapping, flag-waving and the mouthing of political

bromides may still elect a man to office, but they are no longer any value in coping with the economic realities of modern life.

The general post-war break-down of capitalist economy gave rise to new schools of political thought, each of which tried to forestall its own country's collapse by resorting to a more or less sharply defined nationalism. At the moment when the productive forces of the world are obliterating boundary lines, and as new means of communication and transportation overcome the barriers of time and space, the governments of the world erect new and artificial obstacles. England abandons its traditional policy of Free Trade. All Europe is fortified by tariff walls. Quota systems are established, the *frank*, the *lira*, the *mark*, the *pound* and the *dollar* are inflated, deflated, and reflated to stimulate the channels of trade. From September 1931, to May 1932 according to a report of the League of Nations, no less than 272 measures were enacted by the nations of the world to restrict international trade. This mad rush towards economic suicide went forward at the rate of more than one decree, law, or edict a day, and the process has probably continued to this moment."

The New Deal statesman of to day like Senator Hammond of 1858, seem to be labouring under the erroneous impression that the world must have American cotton, and will pay any price the Amrican people choose to fix. World prices means nothing to them. The lesson of Britian's futile attempt to do the same thing with crude rubber a few years ago has been lost on the Brain Trusters. They have even failed to profit by the example of the Republican blunder in October 1929 when with disastrous results, the cotton price was pegged. The only result of that manoeuver was to make foreign buyers restrict their orders and turn for help to other cotton producing nations which immediately, smelling potential profits, increased their planting. That nation, in its right mind, would not ? The opportunity was too golden to be missed. Low-priced alternative crops, such as coffee in Brazil were replaced by cotton. W. L. Clayton head of the largest cotton exporting house in the world, posed the problem in this fashion.

" If the State of Texas with about forty per cent of the cotton acreage of the United States, should attempt, irrespective of any action by the other cotton states, to fix and maintain an artificial price for Texas cotton, all informed people would agree that such a course would end in failure. Yet the United States, which occupies much the same relative position in the cotton world as Texas occupies in the cotton South, has been attempting since October, 1929, to do just that."

To those who argue that American cotton is merely sharing the fate of all other products at the hands of foreign buyers, it may be well to emphasize that their foreign customers have been increasing their purchases of many American made commodities at the same time that they have been decreasing their purchases of American cotton. Of nine articles of export alone, American foreign trade increased by about fifty per cent, or S 350,000,000 in 1934 over the previous year. But such facts evidently have little meaning for the rampant New Dealer. That they are quite satisfied with the results achieved is obvious from this passage in the Agricultural Year Book 1934—

"Up to the present the American cotton policy stands justified...... by the results......We must not permit an increase in foreign production to stampede us back into over-planting. Our cotton policy has succeeded thus far because it operated to an adjustment to the demand. That is the formula for its success in the future."

Southern planters, ginners, brokers and manufacturers, naturally do not share this optimistic point of view. They are thoroughly alarmed as they see their foreign markets grabbed from under their noses. While American fields are ploughed under, Brazil, Mexico and Peru enjoy an unprecedented cotton boom. The Goverments of these countries actively promote the cultivation of cotton; American Banks and business firms are providing the needed capital to build gins, warehouses and oil mills. American gin manufacturers have sent their most alert salesmen to South America and Australia; sales to Brazil alone show an increase of 500 per cent in 1934 over 1933. Thus, while the New Deal politicos let us know that all is well, American bankers, manufacturers and agricultural experts invest their money and their brains in newer cotton countries of the Antipode. They know when the ship is sinking.

Invention of Cotton Picking Machines.—Two humble inventors from Texas, John and Mack Rust, have invented and perfected a cotton picking machine which will vastly change cotton culture in America and abroad. This machine is expected to revolutionise the industry as completly as had whitney's cotton gin at the close of the eighteenth century, commercial tests made during the autumn of 1935 have indicated to confirm this opinion. It has been demonstrated that the machines are field worthy; they have fulfilled every claim made for them. The planters in the Southern States are demanding the machines; and the Company is preparing to go into large scale production.

Its effect on America's Position.—Foreign producers have long known that if a successful picking machine were devoloped, they would be enabled to break the back of America's strangle-hold on world cotton. Thanks to the political myopia of American Statesmen, however, that monopoly has been broken without such a machine. The advent of the cotton picker now will serve to accelerate the growth of South American and Australian cotton culture to an unheard of degree. Letters from all over the world poured in upon the Rust brothers and the visit to America of representatives from more than a dozen countries to examine the machine, all indicate that the big battle for the cotton markets of the world is about to begin.

Great Britain's Position.—Great Britain's stake in the cotton industry is, in a sense, as great as American. And what have the English done about it ? Leading cotton merchants and manufacturers there have long recognised the economic and commercial instabiliiy of the business. From the inception of the industry itself England has been dependent upon foreign counties for raw material. Lancashire with its 800,000 textile operatives lives almost entirely by its ability to transform cotton into yarn and cloth. Raw material is its very breath of life. The failure of Britain to possess the means of direct control over this product so vital to the well-being of millions of its inhabitants, caused the Government to create the Empire Cotton Growing Committee. A corporation was set up under the joint auspices of the Government and the manufacturers to which immediately after the world war, the Government made a grant, of £ 1,000,000 so that work could get under way. The spinners, in turn, agreed to pay a voluntary levy of six pence on every bale of cotton imported into the United Kingdom, so that the Corporation would be able to continue its work. A few years ago, by act of parliament, the tax was made compulsory. It yields an annual income to the Empire Cotton Growing Corporation of approximately £ 100,000.

This sensible attempt of the Government and the textile interests to secure economic self-sufficiency yielded tangible results in a short time The experts of the Committee turned to Egypt, Uganda, Nigeria, Sudan, South Africa and Australia. Nothing was done in India as its cottons were too poor in quality for use in the Lancashire Mills. Patriotic appeals free land and seed bonuses - these and a score of other devices were used in the campaign to free Britain from the yoke of the American planters. Within fourteen years Egypt had doubled its production and attained maximum output. Production likewise was stepped up in the other African possessions, but this increase was seriously affected by such

factors as unfavourable climate, inadequate and costly transportation, lack of man power, or the need for stupendous irrigation projects. Africa, the British now realize, will never be able to meet the demands of the mills of Lancashire. They must look elsewhere for an adequate supply of cotton. But where ?

Possibilities in Australia.—The answer is Australia. According to its official Year Book, the Commonwealth possesses 587,000 square miles of pontential cotton land, which translated into acres amounts to 375,680,000 This represents fully twentyfive per cent more than the acreage of the American belt. Australia has ample rainfall for cotton culture, but unfortunately there is little or none of it during the picking season. The actual cost of transportation from Sydeny and Melbourne to Liverpool is only slightly higher than from American ports. And, as Richard Harding, Secretary to the British Cotton Delegation to Australia in 1922, points out.

" The differece between the seasons of the Northern Hemispheres gives to Australia an advantage that more than compensates for her heavier freight expenses. As the Australian crop ripens some six months after the American crop, it arrives in the United Kingdom when the English market is more or less depleted of cotton, and consequently benefits by carrying charges that have to be paid on American cotton."

Australian cotton lands lie near the coast. Tbe transportation system is among the most modern in the World. Good roads are plentiful and the large scale use of motor trucks is an established fact. The cotton lands (unlike many of South America which have been worked out through long years of careless cultivation) are new and fertile nor are they covered by heavy forests and jungle vegetation. All that is needed, in most cases, is to plough the land and plant the seed. Long, low, rolling hills alternating with endless miles of flat, level prairie make an ideal area for large-scale mechanical farming. Nor must we forget that Australian lands are cheap, absurdly cheap. In Egypt cotton acreage averages nearly S 700, in the United States it varies from S 100 to 500. But an Australia the best cotton land can be obtained for S 35, the average price being from S 5 to 10.

The reader may ask why Australian cotton production has been so small when so many factors were highly favourable. The answer is high picking costs and lack of man power. More than half the population live in a few large cities, the rural element numbering less than three millions. Because of this shortage of farm labour the cost of picking cotton repre-

sents from fifty to sixty percent of the total cost of production. (In the United States, picking represents from twenty to twenty-five per cent of the total cost), the President of the Queensland Cotton Board points out :" how important the perfection of a mechanical picker would be to those who grow cotton under conditions such as these. A mechanical picker which would pick satisfactorily here for 1d, (2c) per pound would revolutionise the industry, whereas in the United States it would be a complete failure." This fact will be more completely realised when one bears in mind that the demands of the labourers in Alabama, Tennessee, and Arkansas in the autumn of 1935 was : one cent per pound for all cotton picked. The prevailing rate varies from one-half to three quarters of a cent. Australian pickers earn from three to six times as much.

Every serious student of the world's cotton markets knows that Australia will soon be the outstanding threat to America. Professor Saunders, discussing the problem before a conference of growers in Dallas, Texas, last year declared.

"If greater mechanisation of cotton production comes in the future Australia offers better opportunity for keen competition with the United States than any other region. Australia has an extensive area, probably greater than our cotton area, where distribution of rainfall is not greatly different from that in our Southwestern cotton region. Distribution of temperature is more closely like that of our Southwestern area than it is in any other cotton country. Furthermore, Australia is the only area where the human resources for using complicated power and pick-ing machinery will compare with those of the United States. All other areas have peasant or poor types of cotton farmers whose illiteracy is rarely under Seventy per cent. Not so with the Australian farmers-they are even better users of the combine harvester than American farmers Undoubtedly, the recent legislation looking toward establishing self-sufficiency in Australian cotton has more real dangers in it for us than most of us think. Australia has the human resources, climate, soil and topographic basis, for profitable cotton production. We are now giving her the golden opportunity to prove the merits of her cotton resources."

Thus an almost immediate revolution in cotton production is at hand the mechanical picker, when introduced in Australia as well as in America, will destroy the American small producer wipe out the American tenant farmer, mechanise the entire industry, cut production costs from

fifty to eighty percent, yield enormous profits to its first users and throw millions of America's most helpless population out of the only employment which they understand.

What is America to Do.—What is America to do? Abolish the system of tenant farming and share cropping? That system of land tenure itself the product of primitive technology of cotton culture, is already doomed to destruction. Introduce a rapid industrialisation? That too is already well under way. But the process of training and absorbing the millions who are being cut off from the land is one that may require decades. It may never absorb more than a fraction of those who will flock to the industrial centres. Give land to the landless? The land itself is of little value when so much of it is sub-marginal, worn out soil. Institute a balance of economy? That such a balance is needed is undeniable.

The crisis in cotton has already become so deep and profound that the whole American nation feels the effects of it. Fundamental readjustments are needed, not political patent medicines. These asjustments can aud must be made. They must be made soon. Unless that be done, the misery and degradation of the cotton districts will be a festering sore upon American economic and social life, poisoning the entire country.

GOVERNMENT CATTLE BREEDING FARMS IN CENTRAL PROVINCES.

Cattle Breeding Policy.—There are at present nine cattle-breeding and dairy farms and five bull depots in the province. Five of these farms are under the direct control of the Officer-in-charge Animal Husbundry Section, three in the Northern Circle are under the control of the Deputy Director of Agriculture, Jubbulpore and one dairy farm attached to the College of Agriculture, Nagpur, is under the control of the Principal, College of Agriculture, Nagpur. The five bull depots are spread over in in the province with the object of stocking the breeding bulls produced on the above-mentioned cattle-breeding and dairy farms, to make it convenient to the purchasers to make their purchases at the depots instead of visiting the producing farms and incurri ng extra expenditure on their transport to their villages.

Bull Depots.—The nine farms mentioned above are situated in various circles and the breed of cattle maintained on each of them is given below:–

Name of Circle.	Area covered.	The place where the cattle-breeding farm is situated.	Breed of cattle maintained.
Southern Circle.	Districts of Nagpur, Wardha Chanda, Chindwara, Betul, Bhandara and Balaghat.	1. Telenkhery Dairy Farm. 2. Cattle-breeding Farm Garhi. 3. College-Dairy Farm.	The well-known milch breed of cows called Sahiwal or Montgomery. Gaolao (an indigenous local breed) A mixed breed of high milking strain.
Western Circle (and Nagpur in C. P.)	All the four districts of Berar and Nimar in C. P.	1. Cattle-breeding and Dairy Farm, Ellichpur. 2. Cattle-breeding Farm, Bod in Melghat Tahsil.	Pure-bred Hansi-Hissar, a well-known dual purpose breed of of cattle. Loal and mixed breed of cows to be mated to pure-bred selected bulls of Hansi-Hissar breed to produce graded cattle
Northern Circle.	Districts of Hoshangabad, Saugor, Jubbulpore and Mandla.	1. Cattle-breeding Farm, Powerkhera. 2. Cattle-breeding Farm, Saugor. 3. Cattle-breeding Farm, Adhartal (Jubbulpore)	Pure-bred Malvi breed of cattle. do. do. A herd of cross-bred cows between Malvi and Sahiwal to be mated to cross-bred bulls of the above-mentioned cross and evolve a suitable dual purpose breed.
Eastern Circle.	All the Districts of Chhattisgarh Division.	1. Cattle-breeding Farm, Pakaria in Pendra. Zamindari in Bilaspur district.	Cross-bred cows between local and medium sized Malvi bulls and further mating them with selected cross-bred bulls to evolve a new breed suitable to the tract.

The five bull depots for stocking the bulls to be issued as breeding bulls are attached to seed and demonstration farm in various circles and are placed as follows :—

(*a*) **Southern Circle.**—There are no bull depots in this circle bulls of Gaolao breed produced on Garhi Farm are brought for sale to Waraseoni

Farm, where they are kept for some time to effect sale and thence a few of the unsold ones are brought to Telankhery Farm and kept there for sale along with the bulls of Sahiwal breed produced on that farm.

(*b*) **Western Circle.**—There is only one bull depot in this circle at Borgaon Farm, where pure-bred and selected bulls of Hansi-Hissar breed produced on the Ellichpur-cattle-breeding and dairy farm, are stocked

(*c*) **Northern Circle.**—There is only one bull depot in this circle, at Khandwa, where pure-bred and selected bulls of Hansi—Hissar breed produced on the Ellichpur-Cattle-breeding and Dairy Farm, are stocked for sale.

(*d*) **Eastern Circle.**— There are three bull depots in this circle at Bilaspur, Chandkhuri and Drug Farms, where the bulls reared at the Cattle-breeding Farm Pakaria, are stocked for sale.

Aims and Object.—The aims of the government in laying out cattle-breeding policy is not only to produce a greater number of good animals, but to produce animals possessing certain definite characters, which they could transmit to their off-springs. The power of transmission is governed and controlled by the purity of blood and it increases with each generation of systematic and scientific-breeding. The characters of importance are:—

(*a*) Those which make the animals produced suited to the environmental conditions of the tract such as soil, climate, food supplies, etc.

(*b*) Those which make the animals by their forms and functions of local commercial value.

In our province the soil, climate and other environmental conditions differ widely from tract to tract and so the demand of cattle of the locality differs widely from that of another. Fnvironment and food supply primarily decide the size and agility of cattle. A big breed like 'Malvi' will not thrive well under normal conditions of Chhattisgarh; a heavy slow-moving type like 'Sahiwal' will fail in hilly tract of Nimar; the quick moving 'Gaolao' breed will not find favour with the Kisans in the plains of Northern Districts, where soil is very heavy. It is therefore, essential to lay out a breeding policy taking into consideration the chief essentials of environment, commercial utility of the animal, want of the cultivators, the object for which the cultivators keep the animals and the type of production, which he expects of them.

While laying out the policy of cattle-breeding operations in this province, all these points were thoroughly considered and the breeds or

the type of cattle to be bred on various cattle-breeding farms suited to various tracts were fixed and only those breeds or types are being bred and maintained on the Government cattle-breeding farms in the province.

Present Needs.—The present needs of cattle for the province are:—

(1) Rural Areas.—(*a*) Rural Berar comprising of Western Circle and Nimar;

(*i*) Activity and rapidity of action; (ii) Increase in size and weight to meet the general tendency to deeper primary cultivation. (iii) Milk in the female as making her worth better care and increasing her ability to nourish her calf.

(*b*) Rural North and Northern Circle:—

(*i*) Capacity for heavy and deeper cultivation, strength and ability to pull more heavy implements than speed. (ii) Milk in the female, if procurable.

(*c*) Rural southern Circle; Nagpur division and parts of plateau:

(*i*) Quick movements with some increase in body weight. (ii) Milk in the female, if procurable,

(*d*) Rural Chhattisgarh and other adjoining rice tracts:—

(*i*) A small, hardy and well muscled male, suited to the condition of the particular climate and food supplies.

(2) Urban and Semi-Urban Areas in the above tracts:—

(*i*) High milking cows.

(*ii*) Efficient working males, suited to the rural needs of the particular tract commanding better prices.

Scientific Methods.—When the desired types of cattle to meet the above mentioned needs are not available in the province, it is no doubt a sound policy to bring in those qualities by adopting scientific methods of breeding; but this process is very slow, involves much time, labour and expenses and the results obtained may not be very satisfactory. In such cases, it is economical and necessary to introduce such breeds from outside sources or province to form a foundation stock and then to carry out further-breeding. The introduction of Montgomery or Sahiwal breed for milk purposes and Hansi Hissar breed for Berar and Nimar tract has been made with the same object in view.

The breeds recommended for various tracts and maintained on various Government cattle-breeding farms with due consideration for supplying bulls for breeding purposes are as mentioned below:—

Area.	Name of farm.	Breed maintained'
1. Western Circle and Nimar (Rural Berar)	Ellichpnr Dairy Farm.	Hansi-Hissar Suitable size of Malvi breed and an experimental new cross-bred breed,
2. Northern Circle (Rural north of the Province).	Powerkhera Sugar Adhartal.	Gaolao breed.
3. Rural Southern Circle	Cattle-breeding Farm, Pakaria.	A new cross-bred breed.
4. Eastern Circle Chhattisgarh	Telankhery Dairy Farm.	Montgomery or Sahiwal.
Urban and Semi-Urban areas, where the supply of milk is of importance.	Ellichpur Dairy Farm.	Hansi-Hissar.

The works to evolve new breeds for Northern Districts and Chattisgarh is in progress and is still in experimental stage.

The first stage in any progress of live-stock improvement in a country is the provison of pure-bred and selected sires. With this object, cattle-breeding farms have been opened so as to produce suitable bulls and supply them in the tract for breeding purposes and to effect improvement in the breed maintained on the farms by practising various methods of scientific breeding. The latter works is always expected and could ouly be done by Government on Government cattle-breedings farms, as it is elaborate, expensive and requires the knowledge of the science of breeding and a good deal of patience. What is expected of the ryots is that they should keep certified bulls given out by Government from the Government cattle breeding farms in their herds of cows, change them every three or four years and make selection and rejection in their herds, as per advice given by the officers of the Agriculture Department.

Premium Bull Scheme.—In order to encourage the use of selected and pure-bred bulls issued from the Government cattle-breeding farms, the 'premium bull scheme' was inaugurated in the year 1922-23, which is working satisfactorily. It started with 19 bulls under the scheme and to-day the total number of such bulls stands at 84. This number is merely a drop in the ocean, when the province has got more than 3½ millions of breeding cows.

The improvement obtained by the distribution of a few pure-bred bulls from Government farms was far from satisfactory, as these bulls were scattered at various places throughout the province and there was no continuity of breeding programme on systematic lines; it was, therefore decided to have a controlled breeding policy for future development. With this idea in view, a scheme of establishing controlled breeding areas at suitable centres, had been inaugurated where a continuity of the breeding programme accompanied by selection of suitable stock, proper feeding and management combined with systematic castration of undersirable males and inoculation against diseases, will be carried out.

Essence of the Scheme.—(1) Under this scheme bulls will be given out free of charge to such of the District Councils, Missionary Societies, Village Uplift Boards and other recognised organizations such as the units of the controlled breeding areas, municipalities and other urban areas, provided a satisfactory organization for the maintenance of the bull can be found.

(2) The bulls will be placed at such centres as may be decided upon by the Deputy Director of Agriculture in consultation with the District Councils or other organizations. The centre or breeding units shall be located in areas, where facilities exist for cattle-breeding.

(3) Each centre or unit will consist of villages or groups of villages and a sufficient number of bulls will be provided to meet the full requirements of the units.

(4) No bulls except those provided through the District Councils of the Department of Agriculture will be permitted to keep in the unit. All other bulls will be castrated or otherwise disposed of Young bulls except such as may be approved for breeding purposes by the Agriculture Department will be castracted or otherwise disposed of, before they reach the age of 18 months.

(5) Feeding and maintenance charges will be met by the District Councils or the recognised organization on a scale prescribed by the Agriculture Department. The headquaters of the nearest Agriculture Department Demonstration Jamadar will be transferred to the breeding centre. He will be responsible for the proper maintenance of the bulls.

(6) No bull will be kept in any one unit for more than three years. At the end of that period, bulls will be transferred from one unit to another or new bulls will be supplied from Government cattle breeding farms or elsewhere.

(7) The centre and units will be regularly inspected by the Deputy Director of Agriculture or the Officer-in-charge Animal Husbandry Section. If it is found that adequate provision is not being made for feeding and maintenance, the bulls will revert to Government.

Conclusion.—The need for the improvement of the cattle in this province is of great importance, as His Exellency The viceroy pointed out, while presenting three pedigreed bulls to Delhi Province: "The cow and the working bullocks have on their patient back the whole structure of the Indian agriculture." But to make the cattle of any province better able to bear this burden, it is necessary to increase their efficiency or economic value either for domestic use or for sale. to achieve this, the co-operation of private enterprise is very necessary, without which it is impossible to go ahead with greater space. The failure of the past efforts were mainly due to (i) the production and distribution of a small number of improved bulls in scattered areas and (ii) want of systematic operations carried by private breeders and absence of continuity. This new scheme of establishing controlled breeding areas at suitable centres will eliminate all the past drawbacks and produce high grade pedigreed sires in required numbers. (*The Hitavad.*)

Gleanings

Marketing agricultural products in New Zealand.—A measure of considerable importance to the farmers of New Zealand was enacted in May of this year, its declared purpose being to ensure an adequate remuneration for the services rendered to the community by the producers of dairy produce and other primary products. The general intention is that, in order to protect producers from the effects of fluctuations in the market prices of their produce, the state should acquire, at prices to be fixed from time to time, the ownership of all such products intended for export and should, if thought desirable, similarly acquire or control the sale of products intended for home consumption. Machinery is provided under the Act to enable plans to be prepared for carrying out this general

intention in respect of such commodities as may be selected from time to time; and detailed proposals are enacted for dealing forthwith with dairy produce, including certain products usually associated with dairy farming such as calves and pigs. *(Jour. of Min. of Agri.)*

Improvement in milk production in India.—India shows us many examples of the success obtained in selecting for milk in indigenous herds. The Pusa herd, of Sanhiwal or Montgomery animals, gave an average yield of milk of 5. 8 lbs. in 1913, and of 14.3 lbs. in 1928. Recent improvements in technique by Sayer have recently still further improved on these figures. One cow Chengi at her second calving gave 6681 lbs. in 304 days in the last year under report. In Madras, the Department started in 1918 to build up a herd of 'Ongole' cattle starting with only 48 cows. The improvement in milk yield is shown below:—

	Av. daily yield lbs.	Total.	Days dry.	Best Individual.
Foundation stock	9.8	2674	177	14.1
Present stock.	11.5	3526	147	25.6

Figures that are more striking, perhaps because a larger number of animals have been under test, come from the Military Department Dairy at Ferozepore, the latest report on which states that "Twenty years" work has resulted in a herd of Sanhiwal cows, with an overall annual yield of 8,600 lbs. of an average composition of 4 % butter fat." The 1914 figures were an average of 5.9 lbs. of milk per head for the whole herd. Such figures are satisfactory; progress has occurred, though to some it may seem slow, too slow indeed when the standard already reached by B. taurus in other countries is recalled. In England a cow called Terling Torch 46th, in her second lactation period, gave 30,000 lbs. in 320 days. Surely, urge the importing' school, surely the right thing to do is to utilise this dairy 'blood' in building up a dairy animal for the Tropics. And we find that this has been done to a considerable extent, and with no small measure of success. *(Madras Agri. Jour)*

Farms for the unemployed.—It is interesting to note that the Punjab Government is forging ahead in launching a scheme of trying a new experiment to make university graduates farmers. The scheme involves the allotment of two squares of land to over 100 graduates. These

persons are required to be in possession of land be prepared to work on the land themselves and not leave it in the hands of tenants. In fact, it is being considered whether it would be better not to let these acquire proprietory rights and give them a sort of permanent tenancy. The idea of the authorities, therefore, is that the houses of these people, though made of mud, should be of the design intended for middle class families, with gardens, and lawns for tennis court. The Government have promised to give all the assistance necessary to make the graduates develop a community life and live in concord, irrespective of differences in religious beliefs. Clubs and games will be encouraged. We wish the scheme success and watch its progress with keen interest. (*Mysore Eco. Jour. Vol. 22, July 1936*).

Can Cows Hold up their Milk?—Can cows voluntarily hold up their milk? It was stated in the January issue of the "Father" that a cow could instantaneously exert this power. In the February issue "Observer" denied that a cow has the power to hold up her milk at will, and affirmed that when this habit occurred it was almost invariably the effect of the treatment to which the cow was or had been subjected. An experienced dairy farmer Mr. A. Montgomerie, Kauwhata) desires to join in the debate. He says he has had quite a number of cows that required to be taught to let down their milk. There are, he says, many sulky cows—one expression of the sulks being milk-holding. The trouble, however, was largely the result of having been badly broken in as heifers. Twenty-three years ago he had a heifer that he valued very highly, and to his intense disappointment she developed this bad habit. After reflection he introduced the calf to her, and after the first few muzzlings the milk promptly arrived almost to bursting point. While allowing the calf some latitude about the under and at the teats he milked the heifer out. This business was repeated for some days until the animal became accustomed to being milked right out, and after that she was quite all right. Since that time he has had several similar instances, but by breaking them in the same way they have all been made tractable, the "cure" taking, on an average, three or four days. Another point to which Mr. Montgomerie has taken exception is that the use of the dog is a cause of the milk-holding trouble.

(It should be stated here that "Observer" expressly said the "hard dog". Doubtless Mr. Montgomerie's claim is that a good dog would not cause trouble. Mr. Montgomerie proceeded to express the desirability of

breaking heifers into the shed (with the use of the dog if one prefers it), the bail and the leg rope before they have calved. Afterwards they would only need to be broken in to the process of milking, and little or no difficulty about milk-holding would be experienced. If an occasional sulkly one did hold the milk back, the useful aid of the calf provides a ready remedy. "Himi," in "The New Zealand Farmer." (*Queens land Agri. Jour.*)

Trees on the Farm.—It is good to observe a growing 'tree consciousness'. especially in areas which, in the march at closer settlement, have been almost entirely denuded of native timber. The usefulness of trees can be demonstrated in these ways: (1) As windbreaks and shelter belts. (2) As isolated or scattered shade and shelter trees. (3) As a reserve supply of fodder for periods of drought. (4) As tree plantations to supply the timber and fuel requirements of the farm, in addition to providing a source of revenue by the sale of products. (5) As screens around dams and tanks to prevent silting up by dust and undue evaporation of the water contents. (6) As a means of preventing erosion on slopes and along the the banks of creeks and rivers. (7) As a means of enriching worn-out or poor land. (8) As ornamental trees in imporving the appearance of the homestead. (9) As bee trees.

Where proper shelter is not provided for stock not only is their resistance to disease reduced but much food material is wasted in meeting the increased demands of an exposed body. This fact has an important application for dairy farmers. A cow's food is only devoted to production after the animal has satisfied its needs for nourishment and heat.

Conservation of the last-mentioned, especially in colder districts and situations, is considerably assisted by judicious tree planting. Shelter belts in the form of trees and hedges are valuable aid to the well-being and productivity of the dairy cow. (*Queensland Agri. Jour.*)

Can Arrowed Sugarcane be used as Planting Material?—The suitability of cane setts cut from arrowed canes as compared with those from young cane is the subject of a study reported in the Phillipine Agriculturist, 25, No. 1. Seed setts from arrowed canes were pieces cut with nodes bearing side shoots actively growing; these were trimmed to diminish transpiration and used for planting; setts from young cane were those from six months old cane cut into pieces each containing two to four or more buds. The results showed that in regard to germination both kinds came up well, the cut setts giving a 7.5 per cent, better germination in December

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planting and the arrowed setts giving a 36.4 per cent, better germination in the February planting. This difference as also reflected in the stand of the cane in the two different seasons. As regards yields of cane the arrowed setts gave a significantly higher yield than the cut setts in the February planting while in the December planting the yields showed no difference between each other. On the whole it may be said that arrowed cane setts were found quite as suitable as cut setts, while on the other hand in the February planting they were found decidedly superior in germination, stand of cane and yields of cane and sugar. These conclusions are of much value bacause there are times when cane arrows profusely and it then becomes impossible to obtain planting material in the usual way, that is from young or unarrowed cane. *(Current Science)*

Central Poultry Institute.—The Government of India have approved of the scheme for the establishment of a Central Poultry Institute at Izatnagar under the administrative control of the Directors of the Imperial Institute of Veterinary Research and have sanctioned a non-recurring expenditure of nearly Rs, 2,75,000, for the constrution of buildings and roads and for certain other capital expenditure and an average recurring expenditure of nearly Rs. 56,000 annually, from 1937-38 on wards for the salaries of staff, etc., of the Institute. The Institute will carry on research on diseaase, nutrition and genetices of poultry and act as a bureau for the dissemination of the results of research in this and other institutions. It will also carry on investigations on processing and disposal of poultry and egg products and make arrangements for courses of training if there be any demand for them. *(Current Science)*.

How the Chinese prepare their compost.—The chinese are utilizing the ponds for the purpose. This is how they do. As soon as the water is about te dry up in the ponds and creeks, they shovel off the wet layers of mud and put them into the fields. They make an excellent manure and fertilizer. Then .they perpare a special kind of compost. Dry leaves are collected from forests and mountain sides and are treated in a particular way. A layar of leaves, farm-manure on the top with mud from the ponds, from the topmost layer. Layers of that kind are piled one above the other until the heap is five feet high. Then the whole is covered with a thick layer of mud so as to prevent water getting in. By the next season, this turns into rich manure. Quite a useful tip to rural cultivators indeed, *(Mysore. Eco. Jour.)*

Debt Relief in Madras.—(a) Land Mortgage Banks—In addition to the Central Land Mortgage Bank, which is subsidised in various ways, there

are now 80 primary Land Mortgage Banks subsidised by Government operating in rural areas. The Government propose to subsidise the establishment of 14 more primary banks in the current year, as recommended by the Finance Committee.

(b) Direct loans by Government to agriculturists—The Agriculturists' Loans (Madras Amendment) Act and the rules thereunder enabling the grant direct by Government of loans for relief of indebtedness of agriculturists were brought into force in October 1935. The essential feature of the scheme is the scaling down of debt. The scheme was started in parts of the Madurantakam taluk in the Chingleput district and the Ramachandrapur and Rajahmundry taluks in the East Godavari district and a sum of Rs. 1.90 lakhs has been advanced as loans in these two districts up to the 15th July 1936 (.85 lakhs last year and 1.05 lakhs this year). As a result of experience gained in these districts, the rules have been amended so as to ensure, as the minimum, the scaling down of debt in principal, plus 5 per cent simple interest or twice the principal, whichever is less. The scheme has been extended to certain areas (mostly those not served by the land Mortgage Banks) in the districts of Kistna, Kurnool, Anantapur, Salem, South Arcot, Trichinopoly, Malabar and South Kanara. A staff consisting of 10 Deputy Collectors, 80 clerks and 70 peons has also been sanctioned, the annual average cost of the staff being about Rs. 1.10 lakhs, exclusive of expenditure on travelling allowance. The progress up to the 15th July 1936 has been as follows:—

(1) Number of applications received 2, 682; (2) number rejected after preliminary enquiry 754; (3) number in which enquiries have been completd 1,373; (4) amount of debt legally but in respect of item (3) Rs. 6. 30 lakhs; (6) amount as scaled down Rs. 5. 06, lakhs; (6) reduction by scaling down and its percentage to the legal debt Rs. 1.24 lakhs (about 20 per cent) Provision has also been made in the budget for the current year for the disbursement of loans up to Rs. 20 lakhs, A larger amount will be made available, if found necessary.

(c) **Debt Conciliation Boards.**—The Madras Dept Conciliation Act, 1936, the object of which is to reduce the burden on agriculturists of their indebtedness by amicable settlement with their creditors through the agency of debt conciliation boards, received the assent of the Governor General in April last. The framing of rules to carry out the purposes of the Act is under the active consideration of the Board of Revenue, and the Government hope to bring the Act into force on receipt of the Board's draft rules. A part from the expenditure that the Government may have

to bear on account of these conciliation boards, the measure will inevitably reduce the revenue from judicial stamps as has been found to be the case in the Punjab, the United Provinces and the Central Provinces where similar measures are in operation, since disputes will ordinarily be settled out of court by these boards. (*A press Communque.*)

Current Research

A biochemical study of the paddy soils of Bengal with special reference to their nitrogen-fixing capacities.—Pran Kumar De and Anil Kumar Pein, (*Ind. J. Agric. Sci.*, 6.746). In Bengal rice has been grown on the same land year after year for centuries practically without the addition of any manure. Obviously, therefore, there is the natural recuperation of soil nitrogen. The present investigation was undertaken to find out whether fixation of nitrogen takes place in the paddy soils under dry cultivated conditions. Nitrogen fixation was studied with six soils. It was found that the amounts of nitrogen fixed in four of these soils, were more than the average amount removed by the crop. This fixation does not seem to be brought about by the common nitrogen fixing organisms of soils, e. g., Azotobacter, B. amylobacter, etc., as some of the soils, containing to Azotobacter, have been found to fix fairly large amount of nitrogen while others containing plenty of them fixed no nitrogen under similar conditions. Algae do not play ony part in this fixation. It is believed that there are present in the paddy soils active nitrogen fixing organisms undiscovered for the present. (*Author's Abstract*).

Utilization of certain forms of inorganic nitrogen during the decomposition of plant materials in the soils.—Jogeshwar Gopal Shrikhande. (*Ind. J. Agric. Sci.*, 6.767) Incorporation of straw with soil depresses the amouut of ammoniacal and nitric nitrogen present in the soil. When straw with an almost equal dressing of ammonium sulphate and sodium nitrate are introduced into the soil, there is a definite preference by the micro-organisms concerned in the decomposition for nitric over ammoniacal nitrogen in the wet cultivated soil whereas reverse is the case in the dry cultivated soil. Nitrate appears to move down faster than ammonia in both the soils. Compared amongst themselves, ammonia goes down quicker in the dry cultivated than in the wet cultivated soil. The rate of movement is rather slow. Practical applications of the results obtained have been discussed. (*Author's abstract*).

On the nature of nitrification in soil.—S. V. Desai and Fazal-ul-din. (*Ind. J. Agric. Sci.*, 6.777). In view of the alleged importance of photo-nitrification or bacterial nitrification predominated in our soil. The following conclusions were drawn as a result of this study:—(1) Photo-nitrification was negligibly small even in summer, (2) Bacterial nitrification in the surface soil ceased during summer when the soil temperature went beyond 49°C. However this does not exclude the possibility of bacterial nitrification going on in the lower depths. (3) various nitrogenous compounds were nitrified from 36. 0 to 64. 7 per cent by the bacterial process, (4) No photo-nitrification took place during winter in any of the compounds tried. (5) Mercuric chloride had no poisoning effect on the catalytic action of zinc oxide. (6) The catalytic power of the soil was slightly increased by the addition of a small amount of zinc oxide. (7) The comparative rates of nitrification by the two processes depend on the conditions under which the experiments are conducted. (8) It was brought out that bacterial nitrification was the only one which was of importance in the soil and that photo-nitrification plays a very minor part in the oxidation of nitrogen in nature. (*Author's abstract*).

Gummosis of citrus in Bombay. B. N. Uppal and M. N. Kamat. (*Ind. J. Agric. Sci.*, 6.803). From 1923 to 1932 the writers investigated Gummosis of mosambi, a horticultural variety of *Citrus sinensis*, which is widely distributed in the Bombay Deccan. The disease is characterised by the copious exudation of a resinous gummy substance and the cracking of the bark for considerable distance upwards from the bud union. The serious aspect of the disease, however, is in the lateral extension of the invaded region. Gummosis also affects the fruit and causes brown rot. The fungus causing gummosis and brown rot of citrus in Bombay has been identified as a typical strain of *Phytophthora palmivora* Butler in the "rubber group" of that species. Experiments on the relative resistance of different species of citrus indicate that pomelo and mosambi are highly susceptible whilst the kagdi lemon, a horticultural vatiety of C. limonia, are almost immune from gummosia. The common mendarin or santra, C. nobilis var. delicious, occupies an intermediate position. Grafting of sweet, commercial varieties of citrus on a sour, resistant stock, such as Jamburi, will prevent gummosia. Both soil and irrigation water should not be allowed to come into direct contact with the bud union, since the fungus enters the cortical issue at the bud union from the soil harbouring infection. However, the best method of treating a deseased tree is to remove the diseased bark and cover the wound with 25 to

30 percent creasote oil; the wound may then be painted with coal tar, if necessary. (*Authors' abstract*).

Decomposition of cane molasses in the swamp soil.—by V. Subramanyam (*Agri. and Livestock in India*, Vol. VI, 1936 P. 488). Cane molasses undergoes rapid fermentation under the conditions of swamp soil, the entire quantity of sugar being decomposed in the course of the first few days. The products of fermentation include gases, chiefly carbon dioxide, methane and hydrogen; non-acid, volatile products such as ethyl acetate and acetaldehyde; and organic acids, chiefly lactic, acetic, propionic and butyric. Of these, the acids account for the major part of the residual organic carbon. Shortly after application of molasses, there is increased dissolution of minerals, chiefly ferrous iron and aluminium, which are toxic to plant growth. After about a month however, they are either precipitated or otherwise removed from solution so that healthy conditions are restored. The nature and extent of dissolution of iron under different conditions have been studied. In alkaline soils, as also those rich in alkaline earth carbonates, only small quantities pass into solution: in others, quite considerable amounts remain in the surface water for about a month. After that period, the iron is partly oxidised to ferric oxide and partly precipitated as the carbonate, sulphide or phosphate. Although there is some fixation of nitrogen consequent on direct application of molasses to soil, the process involves considerable wastage of organic carbon. There is evidence to show, however, that if the initial fermentation is conducted under conditions of reduced air supply, then the greater part of the sugar will be converted into organic acids. The latter, if applied to the field as their mixed calcium salts, would lead to enhanced fixation of atmospheric nitrogen. (*Author's summary.*)

Determination of phosphorus in soils.—by W. McLean (*Jour. Agric. Sci.* Vol. XXVI, Pt. 3 July 1936). Phosphorus in hydrochloric acid extracts of soil may be conveniently determined by digestion with sulphuric and nitric acids. By boiling soil with hydrochloric acid (B. P. 110°C.) for 48 hours under reflux an end-point of extraction is reached. Digestion of soil with sulphuric and nitric acids gives results in agreement with results by 48 hours hydrochloric acid extraction. It is suggested that the phosphorus thus extracted represents a definite category of soil phosphorus which may be taken as the total phosphorus present in the soil. Details of the suggested method are given. (*Author's summary.*)

The eradication of weeds in Cereal crops by sulphuric acid and other compounds.—By G. E. Blackman and W. G. Templeman. *Jour. of Agric. Sci.* Vol. XXVI, Pt. 3 July 1936 page 368). In continuation of earlier work on the destruction of annual weeds in cereal crops some thirty-four replicated experiments have been carried out during 1934 and 1935 in widely different localities. Besides sulphuric acid, nitric acid, ammonium and sodium hydrogen sulphates and ammonium thiocyanate were tested while the effect of a wetting agent was also studied. In every experiment the solution was applied by means of a knapsack sprayer at the rate of 100 gallons per acre. In general at the time of spraying the weeds here in the seedling stage, and the cereal crop not more than 6 in. high. Counts of the weed density were made in order to estimate the degree of control, while in the majority of the trials the yield of the cereal was determined. Sulphuric acid at a concentration of 9.2 per cent. (1 gm. H2 S04 per 100 c. c.) gave a 90 per cent control of Brassica Arvensis (average of nine experiments) and when a 13.8 per cent strength was used it gave a 95 per cent. control of *Raphanus raphanistrum* (average of eight experiments). Nitric acid at equivalent concentrations was slightly but significantly more effective in three out of nine trials for the eradication of these two species. Ammonium hydrogen sulphate (23.6 per cent.) or ammonium thiocyanate (3-10 per cent.) did not, on the whole, compare favourably with sulphuric acid. Decreasing the concentrations of sulphuric acid by a third resulted in a less effective destruction of *Brassica arvensis* or *Raphanus raphanistrum.* This loss of efficiency at the lower concentrations was not corrected by the addition of a wetting agent (Agral 1 at 0.1 per cent.); similar results were obtained for nitric acid. The resistance of *Papaver Rhoeas* to sulphuric acid increases with age. In the youngest stage of growth over a 90 per cent. control was obatined with a concentration of 18.4 per cent. In two out of six experiments, the addition of a wetting agent gave a higher " kill." An effective control of Chrysanthemum segetum was obtained with a 13.8 18.4 per cent. concentration of sulphuric acid only when the wetting agent Agral was included in the spray. A 27.6 per cent strength partially eradicated both *Scandix Pecten-Veneris* and *Anthemis cotula* (51.5 and 73.2 per cent. control.) The addition of Agral led to a greater suppression (87.6 per cent.) of *A. cotula.* The suppression of *Brassica Arvensis* by sulphuric acid increased the yield of the cereal by 12-13 per cent. in two out of the seven trials. The eradication of *Raphanus raphanistrum* has resulted in a higher yield in seven out of the ten experiments, the increase ranging from 58 to 227 per cent. In only one out of the five experiments on *Papaver Rhoeas*

did spraying with sulphuric acid led to a higher yield. The control of *Chrysanthemum segetum*, *Anthemis cotula* and the partial control of *Scandix-Pecten Veneris* gave increases of 20,46 and 86 per cent respectively in the three experiments. Nitric acid, in comparison with sulphuric acid, gave greater yields in five out of ten trials. In four out of these five trials the addition of nitrochalk (22.5 lb. nitrogen per acre) after spraying with sulphuric acid increased the yield to the same extent as nitric acid. Sulphuric acid does not normally depress the crop yield. In a very dry spring some damage may occasionally occur, depressions of 15.8,16.0 and 29.7 per cent. were recorded. The addition of Agral to sulphuric acid depressed the yield by 6.9-17.0 per cent. in three out of twelve experiments; barley would appear to be more susceptible than oats or wheat. Ammonium thiocyanate lowered the yield of oats by 33.4-61.4 per cent. The malting quality of barley was not appreciably lowered by spraying with sulphuric acid or sulphuric acid and Agral, but nitric acid diminished the value of the of the sample. It is concluded that the order of the increase in yield of the cereal due to the suppression of weeds is dependent upon the weed species, but is not directly correlated with the density. In a dry spring competition is less severe than in a wet spring. (*Author's summary.*)

Crop Forecasts

FIRST FORECAST 1936-37

COTTON

All India.—This forecast is based upon reports on the condition of the cotton crop at the end of July or early August. The reports do not, as will be seen from the detailed notes below, relate to the entire cotton area of India but to only 79 per cent of the total. The area sown is at present estimated at 15,769,000 acres as compared with 15,271,000 acres (revised) at the corresponding time of last year, or an increase of 3 per cent. Weather conditions at sowing time were not quite favourable, as sowings are reported to have been delayed in places by absence or deficiency or rain. The present condition of the crop, on the whole, is reported to be fairly good. Detailed figures for the Provinces and States are as follows :—

Provinces and States.	Acres (Thousands)		
	1936-37	1935-36	1934-35
Bombay-Deccan (including Indian States).	1,302	1,496	1,141
Central Provinces and Berar.	4,099	4,282	4,303
Punjab (including Indian States.)	3,305	2,807	2,442
Madras.	286	(a) 302	198
United Provinces (including Rampur States.)	575	558	805
Sind (including Khairpur State)	855	779	(b)
Burma.	518	461	386
Bengal (including Tripura State.)	74	73	73
Bihar.	31	31	38
Assam.	37	35	34
Ajmer-Merwara.	15	14	15
North-West Frontier Provinces.	17	17	20
Orissa.	5	5	5
Delhi.	2	3	2
Hyderabad.	1,485	1,420	745
Central India.	1,270	1,145	1,122
Baroda.	833	808	647
Gwalior.	608	614	632
Rajputana.	436	406	372
Mysore.	16	15	11
Total.	15,769	(a) 15,271	(c) 12,991

(a) Revised. (b) Not available. (c) Excluding Sind.

A statement showing the present estimates of area classified according to the recognised trade descriptions of cotton is given below.

Descriptions of Cotton.	Acres (Thousands)	
	1936-37	1935-36
Omras-Khandesh.	1,225	1,266
Central India.	1,878	1,759
Barsi and Nagar.	811	904
Hyderabad-Gaorani.	719	725
Berar.	2,798	2,894
Central Provinces.	1,301	1,388
Total.	8,732	8,936
Dholleras.	255	236
Bengal-Sind-United Provinces.	575	558
Rajputana.	451	420
Sind-Punjab.	2,249	(a) 2,659*
Others.	41	41
Total.	3,316	(a) 3,678*
American-Punjab.	1,466	947
Sind.	464	(b)
Total.	1,930	(a) 947
Broach.	578	572
Ca-ompta-Dharwars.	27	18
Westerns and Northerns.	112	103
Codandas.	24	19
Tinnevellies. Salems. Cambodias.	162	187
Comillas, Burmas and other sorts.	633	575*
Grand Total.	15,759	15,271*

* Revised.

(*a*) Details of arears under American and Desi varieties in respect of Sind and the Indian States of Punjab not being available, the entire cotton area of these tracts has been included under Sind-Punjab (Bengal-Sind.)

(*b*) Included under Sind-Punjab (Bengal-Sind.)

The provincial reports are summarised below. The figures in brackets following the name of each Province or State indicate the average percentage of cotton area in that tract to the total area under cotton in India based on the figures for the five years ending 1934-35.

Central Provinces and Berar (18.5 per cent).—The area sown is estimated at 4,099,000 acres (2,798,000 acres being in Berar), which is 4 per cent below the estimate made at this time last year. This weather during the first half of June was generally cloudy and light to moderate showers were received throughout the province. The regular monsoon set in by the 15th June and there was moderate to heavy rainfall in all the districts until the close of the month. The rainfall during the first week of July was heavy almost everywhere, which was followed in the Central Provinces proper by an opportune break in the second week and by occasional moderate to heavy showers with bright intervals in the last half of the month. In Berar after the heavy rain at the beginning of July, there was a sustained break, which was followed in the third week of the month by light showers in most tracts since then, good rain has

Provinces and States.	1936-37 Acres.	1935-36 Acres.	Increase (+) or decrease (−) Acres.
United Provinces (a)	2,469,000	2,010,000	+459,000
Punjab.	491,000	464,000	+ 27,000
Bihar.	465,000	438,000	+ 27,000
Bengal.	353,000	325,000	+ 28,000
Madras.	99,000	(b) 97,000	+ 2,000
Bombay (a)	111,000	94,000	+ 17,000
North-West Frontier Provinces.	59,000	46,000	+ 13,000
Assam.	35,000	33,000	+ 2,000
Central Provinces and Berar.	31,000	30,000	+ 1,000
Orissa.	26,000	(b) 32,000	− 6,000
Delhi.	4,000	5,000	− 1,000
Sind.	5,000	(b) 4,000	− 1,000
Hyderabad.	47,000	48,000	+ 1,000
Bhopal (Central India)	6,000	5,000	+ 1,000
Baroda.	3,000	2,000	+ 1,000
Total.	4,204,000	(b) 3,633,000	+ 571,000

(a) Including Indian States. (b) Revised.

been received at intervals in the Central Provinces proper, and a few showers in Berar. Sowings were made generally under favourable conditions and germination was successful. Some re-sowing was, however,

necessary over small areas in five districts owing to very heavy rain. The weather has been favourable for weeding and intercultural operations which are in full swing. The present condition of the crop is reported to be good and prospects and hopeful.

SUGARCANE

All India.—This forecast is based on reports received from Provinces and States which contain, on an average, 95 per cent of the total area under sugarcane in India. The reports relate generally to conditions upto the beginning of August. The total area planted with sugarcane this year is estimated at 4,204,000 acres, as against 3,633,000 acres, the corresponding area (revised) of last year, or an increase of 16 per cent. Weather conditions at the time of planting were generally favourable. The present condition and prospects of the crop are generally good but certain areas in the United Provinces are reported to have been affected by floods. The details for the Provinces and States are as follows :—

Central Provinces and Berar. (0.8 per cent.)—The area is estimated at 31,000 acres, as against 30,000 acres, the corresponding area of last year. Weather conditions at the time of planting were favourable and germination was successful. With light to moderate showers at the beginning of June, the regular monsoon broke by the middle of the month and rainfall upto the time of report has been adequate. The condition of the crop is reported to be satisfactory and prospects are promising.

Calender of Operations

FLOWERS

By R. N. Sinha

August.—Seeds for cold weather use may be ordered during this month. Any of the following seeds may be ordered according to one's choice. When the seeds have been received they should be kept in air-tight tins bottles or boxes till they are required for sowing :—

Gypsophilla.
Gereniums.
Helichrysum (Everlasting flower.)
Linum Grandiflorum (Flot.)
Nasturtium.
Astar.
Anterrihinum (Snapdragon.)
Alyssum.
Carnation.
Candytuft.

Pansy.
Petuna.
Poppy.
Phlox.
Mignonette.
Salvia.
Sweet Pea.
Small sunflower.
Cornflower.
Coreopsis.
Calandula.
Chrysanthemu Sagetum.
Datura.
Dianthus chinencis (Pinks.)
Gillardia.

Seed beds as suggested in the month of May, may be prepared, manured and kept ready for sowing. The seed beds must be forked just a day or two before sowing seeds as the seeds germinate better on freshly dug soil. At the time of sowing the condition of the seed bed soil should be moist.

In order to obtain good results from sweet peas, have the trench dug to a depth of about 1½ to 2 feet and after mixing in well rotted cattle dung manure in the excavated soil fill the trench and occasionally have the surface forked in order to keep back the weeds till sowing in October. Planting of croton cuttings, hedges and borders may be carried out in this month also.

Whenever weather and time permit, do not fail to hoe the flower beds.

For obtaining early flowers acclimatized astar and salvia splendens seeds may be sown in boxes or pots, by the middle of this month.

If not already done, stake the chrysanthemums and alsc do not fail to water them on open days. They should not be allowed to flag.

September.—First sowing of acclimatized seeds may be done in the first week of this month and second sowing of English seeds (imported) in the second and third weeks in instalments.

Seeds of tap rooted annuals such as candytuft, mignonette nasturtium, alysseum may be sown in the last week of this month direct in the ground where they are to grow.

If possible, first and second sowings of all the seeds which require transplantation may be done in boxes or pots instead of beds, of particularly delicate seeds like poppy, petunia, nicotiana.

Balsams will be coming to an end this month and they should be removed without delay. The seeds obtained from these are not of much use since acclimatized seeds produced only single flowers.

In order to obtain big blooms on chrysanthemums disbudding and application of liquid manure should be started in this month.

Seedlings of salvias and acclimatized astors will be ready for planting. They may be transplanted in beds or potted in pots and transplanted in beds later on.

Operation of putting cuttings of different shrubs may be started in this month.

Budding of roses also can be started by end of this month.

October.—Sowing of flower seeds, budding of roses and planting of cuttings may be continued during this month.

The rainy weather annuals which may be finishing up should be removed. If desired seeds may be collected from cosmos, cleomia, celosia, gamphrena, melanpodeum, torenia, sunflower and amaranthus, but it is no good collecting sinnia seeds. As a rule acclimatized sinnia seeds produce mostly single flowers.

After preparing the beds any seedlings which may be ready from September sowing may be transplanted.

Sweet peas, candytuft, mignonette alysumm may be sown direct in the ground where they are to grow. Sweet pea seed would germinate better and earlier if soaked in water for about 12 hours before sowing.

Pruning of roses and flowering shrubs may be carried out in this month.

Violets may be re-potted.

VEGETABLES

August.—Acclimatized cauliflower seeds may be sown in the first week where an early crop is required. As a rule cauliflowers produced from this seed are small, loose, and yellow in colour, while those grown out of English (imported) seeds are solid, larger and whitish in colour and give good results.

The sowings of English cauliflower and cabbage seeds may be taken up from the middle of this month and may be continued till the end of September, at intervals of 10 or 12 days.

The first and second sowings may preferably be done in boxes and as the seedlings have produced five leaves they may be transplanted 2 or 3 inches apart on raised beds, prepared beforehand for the purpose.

The seed beds should be 6 to 9 inches higher than the ground level, and about 4½ feet broad and the length can be according to convenience.

During this season caterpillars are very troublesome to these seedlings. The following hints may be of some use.

Keep the surroundings free from weeds and grass. Hand picking of the caterpillars and spraying with arsenate of lead are more beneficial. If this is not available dusting with wood ashes is recommended.

In places where the duration of the cold season is short only early varieties of cauliflowers should be grown.

Early varieties.—Early, Eurfurt, Early Snowboll, Early Paris and the early giant.

Late varieties.—Magnum, Benum, Welchern, large Aseatic. One ounce of seed contains about 1000 seeds of cauliflower and about 800 seeds of cabbages.

It is desirable to sow a little more seed than is actually required for the area to be planted, specially in cases of cauliflower, cabbage and knolkhol. Not more than 50 per cent of the seed may be expected to produce good seedlings for planting.

Lettuce seeds also may be sown in this month for an early crop but these will not be nice and full.

Brinjal seeds can be sown for the cold season crop. Country radish seed may be sown direct on ridges.

September.—The following vegetables may be sown in this month—Cabbage, Cauliflower, Knolkhol, Lettuce, Tomato, Brinjal, Beet, Turnip, Carrot and Radish (local and imported.)

Knolkhol seedlings will have to be raised in the same way as cauliflower and cabbage.

Lettuce, tomato and brinjal seeds will have to be sown in beds and seedlings, when ready, transplantad in their permanent places.

Seeds of beet, turnip, carrot and radish will have to be sown direct in the beds where they are to be grown.

French beans may be sown in the last week of this month as a trial.

October.—All the vegetables recommended for the previous months may be sown (except cauliflower) with advantage in this month for successive crops with better results.

In addition to the above-mentioned crops, peas, onions and spinach may also be sown in this month.

Mint may be transplanted.

College and Hostel News

The college re-opened on the 15th of June after the summer vacation. The classes resumed work after an address by the Principal to the students and staff.

The election of the office bearers took place on the 27th June. To lessen the burden of the General Secretary a new post of General Secretary for games and sports has been created. This change has been effected to create enthusiam and zeal amongst the students of the college and to encourage them to take greater intrest in all the games. The General Secretary for games is supposed to look after the games and their management.

A change has been introduced in the system of election of the Secretaries of different games. They used to be elected at a general meeting of all students but this year they were elected by their respective teams.

The general health of the students is satisfactory.

We congratulate the following on their election as office bearers for 1936-37.

General Secretary.	Mr. W. B. Date	3rd year.
General Secretary for Games.	Mr. G. K. Bhake	„
Foot-Ball Secretary.	Mr. G. K. Bhake	„
Cricket Secretary.	Mr. R. K. Wadaskar	„
Tennis Secretary.	Mr. M. S. Kiledar	„
Hockey Secretary.	Mr. N. B. Gupta	2nd year.

College Debating Society.

President.	Mr. E. A. H. Churchill.
Vice-President.	Mr. T. H. Koyal.
Secretary.	Mr. P. R. Roday.
Joint-Secretary.	Mr. B. P. Upadhyaya.

The new facilities given to graduates in Agriculture have attracted many young men to this college. This year more than 150 young and enthusiastic students sought admission in this college but as accommodation was limited to sixty, many had to go back disappointed.

The first year class was formed on the 4th July with 59 students on the roll. The class is thus very strong this year. Due to want of accomodation in the hostel some students are permitted to live with their guardians,

The first meeting of the College Debating Society was held on the 18th July with the Principal in the chair.

Mr. Shridhar Rao Gokhale gave an interesting lecture on "The administrative arrangements in the rural areas especially the villages."

We thank him for his kindness and enthusiasm shown in coming here and giving us a fund of knowledge in an interesting manner.

We heartily congratulate Mr. R. L. Gupta, B. Ag., on his having secured the scholarship for post-graduate training in Entomology.

We take this opportunity to thank the ex-secretaries who had taken keen interest in the discharge of their duties.

The Nagpur Agricultural College Magazine

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Original Articles

SOME OBSERVATIONS ON SESAMUM INDICUM L.

By R. H. Richharia, M. Sc., Ph. D.

(*Agricultural Research Institute, Nagpur, C.P.*)

CONTENTS

1. **Introduction.**—*Sesamum indicum* is an important oil-seed crop in India and has been the subject of investigation at Pusa and other places for a number of years: Howard Howard, & Khan (1919) Kashi Ram (1930), Roy (1931). Sufficient work is being done on pure line selection and the inter-varietal crosses. Other methods such as the inducing of polyploidy; mutations etc, must also be tried. Since the haploid chromosome number in this species is only thirteen it gives an especial advantage of following the new forms cytologically as well.

The existing til crop possesses several drawbacks such as the occurrence of stem-bending, sepaloidy and cytological irregularity etc. which reduce the yield to a considerable extent. The present account deals with some features of these phenomena.

2. **Stem bending.**—Plants with bent stems are very frequently observed in Kharif crop (see Photograph). Naturally as a result of this the top inflorescence in some cases becomes very weak and thus the development of the capsules is very much affected.

At an earlier stage when the stem bending has not occurred the top portion near the apex is attacked by some disease which first affects the epidermis and later on the underlying cortical tissue (mechanical tissue). Infection does not proceed beyond the cortex *i.e.* the vascular bundles and the pith are not attacked. The colour of the stem gradually turns brown, reddish brown and ultimately completely black. Figure 1 is the transverse section of the stem showing the normal and the infected portions.

Photograph showing inflorescences of *til* (*Sesamum indicum*) with the bent part and the sepaloid flowers.

A, Notice the bent part of the inflorescence.

B & M, Notice the dense over-crowding of sepaloid flowers at the top and normal capsules towards the bottom.

C—K. Some common types of sepaloid flowers and fruits.

C,D & E, Abnormal development of gamopetalous corolla.

F,G & H, Abnormal development of pistil.

I, J & K, Capsules which look quite normal externally possess sepaloid ovules inside.

L, Normal Capsule.

When the mechanical tissue is destroyed at a very early stage the bending of the stem is naturally the result. But this does not continue unlimited, and as the development of the other tissue (vascular bundles and the pith) proceeds the bent portion becomes strong enough to support the developing inflorescence.

Since the bending was more pronounced in some types than in others, while some were completely free, it should be possible to obtain resistant types with desired characters by breeding.

Sepaloidy.—Robertson (1928, cf. Pal and Nath, 1935*), Kashi Ram (1930) and Roy (1931) record the occurrence of sepaloidy in this crop. Pal and Nath (1935) also record the same phenomenon under the term "Phyllody." This phenomenon is very commonly observed in this Province which reduces the yield of the crop to a considerable extent. Various parts of the flower become leaf-like to a variable degree and thus it becomes functionless. Such flowers are called sepaloid flowers among which various types are noticed as has already been pointed out by Roy. Plants suffering from this defect can be easily noticed by the dense over-crowding of the sepaloid flowers and their complete greenness (see Photograph). Some common types of sepaloid flowers and fruits are also shown in the accompanying photograph. It is very probable that some genetical disturbance might be responsible for its occurrence. But at the same time soil conditions should not altogether be over-looked. Pal and Nath think that it may be due to a virus.

4. **Meiosis.**—The meiotic chromosomes were examined on smear preparations fixed in the following fixative followed by the Iodine-Gentian-Violet method of staining.

1 % chromic acid	...	...	5 cc
15-20 % Formalin	...	...	2 cc
Glacial Acetic Acid	...	...	1 cc

* These authors also mention the following references in this connection: Deighton (1931); Wallace (1933, 1934); Storey (1933).

Seeds belonging to the Kharif variety were sown in the beginning of September 1936 (which is of course not the normal time) and the plants flowered in the middle of October, which were cytologically examined.

At I metaphase thirteen bivalents are clearly observed with a distinct nucleolar body (Fig. 2). The remaining process is quite regular resulting in tetrads. It is remarkable to notice a nucleolar body till the end of the process (Figs 3 and 4.)

In one preparation dyads were also observed, which suggest the formation of the restitution nucleus at the reduction divisions.

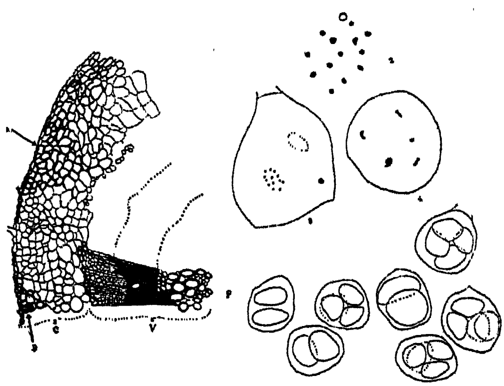

Fig. I, Transverse section of til stem (Sesamum indicum), attacked by some disease. X about 103.

C. Cortex.

D, Tissue (shown by deep black) is attacked by some disease.

V, Vascular bundles.

P, Pith.

Figs. 2-4 Meiotic chromosomes in *S. indicum.*

Fig. 2 I metaphose polar view showing thirteen brivalents and a nucleolar body. X about 3500.

Fig. 3 II metaphase plates. The upper plate is seen in slanting position. Notice the nucleolar body at right angle to the spindle axis. X about 1160.

Fig. 4 End of the second division. Notice the persistence of a nucleolar body. X about 1160.

Fig. 5 Tetrads and dyads from *S. indicum* X about 800.

(While reproducing the figures have been reduced to about one-third).

The cytological irregularity resulting in dyads as observed here does affect the fertility of the plant. Whether this irregularity is due to the environmental conditions, for the Kharif plants were sown under different conditions, or due to some genetical disturbance is difficult to decide for the present.

Summary

Observations on some phenomena which reduce the yield of *til* crop are recorded, viz. stem bending, sepaloidy and cytological irregularity.

At a very early stage the epidermis and the cortical tissue (mechanical tissue) are attacked by some disease which causes stem bending. Vascular bundles and the pith are not affected.

Different parts of the flower become vegetative to a variable degree (sepaloidy) and thus become sterile. This might be due to some genetical disturbance. Soil conditions, however, should also be investigated.

At I metaphase thirteen bivalents and a nucleolar body are observed. The latter persists till the end of II division. The presence of dyads suggests some irregularity at meiosis.

I am very thankful to Mr. J. C. McDougall, M.A., B. Sc., Director of Agriculture and Mr. K. P. Shrivastava, second Economic Botanist for giving me all facilities, to work in this Institute.

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A RETROSPECT AND PROSPECT OF THE INDIAN COTTON INDUSTRY.

By J. P. Tiwari, B. Ag.

Amongst the Oriental Countries, India is characterized from the remote antiquity as the land of cotton. India enjoyed the privilege of producing the highest quality of cotton till recently and is outranked today in cotton production only by the United States of America.

The Hindus seem to have realized the utility of cotton since pre-historic days and the first known mention of cotton is found in a Rig Veda hymn, composed probably fifteen centuries before Christ, which honours "the threads in the loom". Frequent references to cotton are also made in the ancient digest of law "The Institutes of Manu", written 800 years before the Christian era. There cotton is mentioned so often and in such a way as to denote that it must have been held in very high esteem by the ancient Hindus. According to Manu, it was required by the religious law that the sacrificial thread of the Brahmins should always be spun from this plant.

The use and diffusion of cotton and cotton goods into other countries was slow but steady. Persia was the next neighbour who acknowledged its extensive utility and carried on cotton trade with India from as early as 569-525 B. C. Persians did not attempt to spread cotton goods beyond their borders. This was probably due to the fact that they were contemptuous of foreign intermixture and were also averse to water journey.

Later on the Greeks knew about cotton from the explorers who accompanied "Alexander the Great" to India in 327 B. C. Theophrastus was one of them. He gives a beautiful description of the cotton plant. He said "The trees from which the Indians make their clothes have leaves like those of the black mulberry but the entire plant resembling a vineyard." Alexander's generals on their home coming described cotton or 'vegetable wool' as the important wonder of the Orient. They admired the skill of the Hindus in the production of fine cotton clothes.

Nearchus wrote that Alexander's soldiers were quick to use cotton for bedding and as pads for their saddles. It is presumed that they took with them assorted specimens of Indian cotton cloth such as calico and muslin. Muslin of Dacca seems to have been well known to them for they called it by the name of Gangitiki. It is so named because of its

availability on the banks of the Ganges. Thenceforth, cotton became the Roman cloth of luxury. From India and Persia, Latin conquerors borrowed the custom of using cotton awnings as protection against the rays of the sun. Cotton sails were also used on Roman ships.

It was the genius of Alexander which assisted the wonderful cotton goods of India to reach Europe. It was he who discovered new highways to link Europe and India for Commercial purposes both over land and through the paths of the sea. Alexander, by his invasion, demonstrated that commerce could be transported through the Persian Gulf towards the interior of Asia minor as well as by Arabian sea to his city. He ordered the removal of dams and cataracts which were impediments for over-land trade. After his death, the completion of the trade routes was accomplished by his generals. The most important was the water way, opened through the Indus and the Arabian gulf to Alexandria. The Indo-Egyptian traffic, thus established, continued for many centuries. Arrian who probably lived in the second century of the Christian era, says that "Indian cottons of large width, fine cotton muslin, plain and figured and cotton for stuffing the coaches and beds" were brought by water from India and launched by way of Egypt towards the countries of the west.

Under Mohamedan rulers in Europe the Egyptian maritime commerce was closed and the transport followed overland by means of stately and picturesque caravan. In order to reacquire the Indo-Egyptian trade routes, Venetians made a treaty with the Mohammadans. The Reopening of Alexander's channels of intercourse enhanced the importance of Venice and it once again became the distributing centre for the cotton goods in Europe.

Influenced by a desire for a freer intercourse for the commercial storehouse of India, Italy and Portugal sent forward two quests for the key to the Orient, Columbus and Vascode-Gama. The object of both was to seek India. Gama was successful. He landed at Calicut the city of Calicos. The immediate result of Gama's discovery was the abundant supply of India products in Europe including cotton goods and a consequent reduction in prices.

This situation, in turn, brought about a greatly increased demand for these plentiful and inexpensive goods of the Orient so that the cotton trade received the greatest impetus. Almost all leading nations of

Europe tried to capture Indian commerce in their respective hands but the English held the sceptre owing to their supremacy in sea. The first import of Indian fabrics in England took place in 1631 through the East India Company. According to Daniel Defoe, the desire for Indian goods seems to have attained a high pitch in English homes. He says " the general fancy of the people runs upon East India goods to that degree that the chints and the painted calicoes which before were only made use of for carpets and to cloth children and ordinary people, became now the dress of our ladies. In short, almost every thing that used to be made of wool or silk relating either to the dress of the women or the furniture of our houses was supplied by the Indian trade."

The popularity of Indian cotton goods in foreign countries was immense and India continued to enjoy that privilege for many centuries. It was not until the last century that clothes equal in quality to those produced in India by the most primitive appliances, were produced elsewhere. Some of the muslins had the most extraordinary delicacy of texture. Tavernier states "some calicoes are made so fine that you can hardly feel them in your hands and the thread, when spun, is scarcely discernable; also the rich have turbans of so fine a cloth that thirty ells of it put in to one turban makes it weigh less than 4 (four) ounces. Ward, in his book of " History Literature and Mythology of Hindus " relates " When the muslin is laid on the grass to bleach and the dew has fallen on it, it is no longer discernable." It is therefore, not surprising to find the poetic scribes of the Orient describing these fabrics as 'webs of woven wind'.

The downfall of Indian cotton manufacturing industry can be traced from the Industrial revolution in England. Mass production on economic basis was mainly responsible for this downfall. English enterprisers began to prepare fabrics identical to Indian manufactures. With patience and untiring efforts, they achieved the perfection and the excellenee in the manufacture of cotton goods for which India held the monopoly with pride. At first, they offered them in the home markets at comparatively low prices. The consequence was that Indian cotton goods lost their foreign markets. English manufacturers were not contented with this. With skill and perseverence they dumped their cotton goods on India. The consequence was that our markets got flooded with cheap English cotton goods. The Indian cotton manufacturing industry became practically extinct.

Till the middle of the nineteenth century, cotton production was limited for self sufficiency. The export of raw cotton was very small. The first regular export of raw cotton from India is recorded in the year 1783. Since then the export has continued either to England or to other nations of the continent but the export of raw cotton was not phenomenal till 1860—the year in which the American Civil War broke out. This caused the blockade of all American ports as regards the export of raw cotton. The outcome of this was the occurrence of a cotton famine in Lancashire. England looked for cotton to India. Inspite of short stapled, dirty and badly handled cotton, the export of cotton from India increased marvellously. This in turn brought about an increase in cotton acreage.

Although the consumption of raw cotton had increased its demand was not universal. The conspicuous drawback in it was its short staple character. In order that Indian cotton should have world wide demand, the British Government made efforts to improve its quality. It carried on numerous experiments to accomplish this. American cotton growers were brought over in an effort to introduce the cultivation of American long staple cottons and large sums were awarded for cotton growing. The great zeal of the British people to raise the economic status of the Indian farmers would be evident from the writings of Mr. J. F. Royle. In his book of "Culture and Commerce of Cotton in India", he says "if we can in any way improve the quality of Indian grown cotton, at the same time that we increase its quantity, we enable the Indian agriculturists to obtain a portion of the millions now paid by England to America and in addition to facilitating the payment of his rent and other expenses, we increase his means of comfort and of comparative wealth, as well as enable to supply himself with the luxuries of his own".

The Agricultural Departments of various provinces have contributed a great deal in improving the quality of cotton. Various means are adopted by the departments to impart instructions regarding the utility of clean and pure marketing of kapas. Distribution of improved cotton seeds has proved an effective weapon to combat and to wipe away disreputed and detrimental short staple varieties of cotton. Necessary legislation is also effected to put an end to the growing evil of adulteration. The logical consequence of the government's multifarious efforts is that a material change in the quality of cotton is now to be

seen. Our province is also playing an important role in constituting the destiny of the future long staple cottons of India.

The land-mark in the history of cotton development in India is the establishment of the Indian Central Cotton Committee in Bombay in 1922 so. It is the outcome of the recommendations contained in the report of Indian Cotton Committee of 1919. Its source of income is the taxation of all cotton whether exported or consumed in India. Although the aims and aspirations are manifold yet its main activites are directed towards research in cotton growing and other technological matters.

So far as the research in cotton problems of economic importance is concerned, it will be interesting to note that the committee is devoting special attention to the investigation in the botanical, physiological, mycological and entomological aspects. For these purposes, the committee either subsidises the research work of the Provincial Agricultural Departments or carries on the work under its direct control. As regards the botanical and the physiological sides of the question various improvements and selections in the existing and in the imported varieties of cotton are made. 1027 A.L.F. is evolved to suit the environment of the Surat tract in the Bombay Presidency. Improved Sind-American cotton seed is being distributed in areas on the right bank of the Indus. On the left bank, efforts are being made to introduce 289F-1, 4F—98 and 27 (Deshi) W.N. Endeavours are afoot for propagating C.402 in the Hardoi and neighbouring districts of Lucknow and Sitapur in the United Provinces. In our own province, much is achieved in the improvement of indigenous varieties. Amongst various new strains, U–434 is making a rapid headway and is securiug universal approval throughout the Central Provinces and Berar. In Deccan, pure Banilla seed is receiving wide attention in canal areas.

With regard to mycological and entomological problems, it will be enough to say that the schemes are launched to invesitgate the causes and the methods to control or to eradicate the pests. Some of the important schemes are C.P. And Berar entomological scheme, scheme for survey of the disease of mal-formation in Punjab-American cotton and Punjab white fly scheme.

In order to carry out experiments and research in spinning fibre and yarn, a technological laboratory is maintained at Matunga in Bombay. Samples of improved strains of cotton, samples of standard

Indian cotton and trade samples of various organisations are tested and their results are embodied in the reports which are published from time to time. These documents are of much importance to mills for they guide them in the purchase and storage of cotton.

The other institute of much improtance is the Indore Institute of Plant Industry which is the centre of research for black cotton soil areas of the Malwa plateau. This is also progressing rapidly. It has evolved two improtant strains of deshi cotton and are known as Malvi No. 1 and Malvi No. 9. These are much superior in yield, ginning percentage and spinning qualities to the local variety. Their distribution is fast multiplying and the anticipations are encouraging.

Inspite of much advancement and perfection in the art of mill cloth production, the handloom industry still continues to survive though in its destitute form. It is probably due to the fact that there are certain designs of clothes of individual choice which, peculiarly enough, can only be produced by handloom. The other cause which lends support to its existence is the sentiment known as "Swadeshi." It means the patronage of home products.

Mr, Vera Anstey, the author of "The Economic Development of India" opines that handloom products represented 22.3 % in 1925-26. Production of 22.3 % handloom clothes is realy remarkable and indicates the trend of public opinion towards the industry. Recently, the Provincial Governments have taken the lead and are encouraging the weavers by financing them. As such, it can be concluded that it is maintaining and will continue to maintain its position in future.

The history of Indian Cotton Mill Industry is of recent origin and can be traced back since the year 1856, when the foundation of the industry was laid by the opening of the first mill in that area in Bombay. In 1887, the famous Empress Mills of Nagpur was established by Mr. J. N. Tata. Thereafter, the construction of mills continued far and wide in India. The industry made rapid progress particularly in Bombay Presidency. In the early days of textile industry mills concentrated on the production of yarn both for Indian and China markets, but later on, they had to deviate their attention on the production of goods mainly for home markets. It was because of the fact that the Japanese had captured the China markets by dumping their yarn and goods. Secondly, China is also developing its own textile industry.

During the Great War, Indian cotton industry received great impetus owing to the huge profits, the mills made. It is presumed that the average profits amounted to 30% during that period. Thereafter the industry had high hopes of wide expansion but the world wide commercial crisis of 1920-21 enveloped India also and it had its due share.

In and after the war, wages in the mills had risen substantially and accordingly, the cost of production was at a high level. High cost of production and the Japanese keen competition in home and foreign markets narrowed the profits of many a mill. Some of them were even on the verge of collapse but the suspension of the cotton excise duty in 1925 gave temporary relief to the mills. This duty was definitely abolished by the finance act of 1926. Inspite of this the position of the mills did not improve especially in Bombay Presidency. In order to investigate and to report on the causes of depression, the Cotton Textile Board was appointed. On detailed enquiry, the said Board made various suggestions. One of them was the protection of industry by legislation. Up to this, the Government imposed certain duties on imported yarn by passing the yarn bill in 1927. The strikes in 1928-29 and the Japanese subversive competition compelled the millowners to reapproach the Government. They pressed the authorities to raise the import duties on cotton piecegoods. Their efforts bore fruits and the cotton Textile Industry protection Act of 1930 was passed.

Efforts to throttle the import of Japanese yarn and piece goods by legislation alarmed the Japanese. Realising their commercial insecurity the Japanese who are the principal consumers of Indian short staple cotton, threatened to boycott the purchase of raw cotton. This had the desired effect and a commercial settlement had to be sought by an Indo-Japanese agreement.

Various explanations are offered by the experts regarding the inability of Indian mills to withstand foreign competition. The chief drawback, which is pointed out, is the lack of able management and proper internal organisation. Managers and managing agents should be persons of vast experience who should understand to work out the cost and should also be able to make right purchases in cotton. Bribery and corruption predominate in mill employers and store purchasers. These irregularities should be done away with. Welfare of the labourers should be the first and the foremost motive. This encourages them and they work with indefatigable zeal which increases both

efficiency and production. The millowners have now realised the defects and they are striving to eliminate them.

At present, the depression has produced abundant, cheap and skilled labour. With the development of organised markets, cheap and quick transport facilities and with improved methods in means of communication, commercial organisation has become much efficient. Moreover, the country is full of all those natural resources which are incumbent for the prosperity of the mill industry. As such, it shall not be merely a dream, if we cherish vistas of glorious expansion of Indian Cloth Insdustry after the deficiencies are made up.

CULTIVATION OF ONIONS

By B. Subba Rao, L. Ag. (Hons.)

Botany.---Natural Order-Liliaceae.

Botanical Name.—Allium Cepa.

The fleshy bulb which is a modified shoot is the part that is highly valued in culinery. The leaves are also used by the poor people as vegetable.

Natural Habitat.—Temperate regions.

Climate.—A breezy climate is preferred to one where the wind does not blow frequently. Nasik grows plenty of onions on account of the fact that it enjoys this advantage.

Soil.—Rich, well drained loamy soils are best suited for this crop.

Cultivation.—The land should be ploughed twice or thrice to ensure a loose condition of the soil. It should then be harrowed twice.

Manuring.—Cattle dung manure at the rate of 30 cart loads per acre should be applied before the last ploughing.

If the above mentioned quantity of cattle dung is not available, an application of Niciphos at 100 lbs. per acre in addition to 15 cart loads of manure may prove useful.

Instead of Niciphos, cake may also be applied at the rate of 300 lbs. per acre.

Lay out.—On light soils check beds are suited. The size of the individual beds depends on the slope of the field. The greater the slope the

smaller should be the size of the beds. A convenient size under normal conditions would be 9 ft. x 9 ft.

On heavy soils ridges two feet apart should be prepared and planting done on the shoulders of the ridges.

Propagation.—Seeds are sown either directly on the land by broadcasting or drilling or they are sown in a nursery and the seedlings transplanted 6 to 9 inches apart when they are about 1½ months old. The nursery should be carefully prepared. It should be rich and well drained so that the seedling may grow quickly. The beds should not be sown thick as the seedling will be drawn out and weak. 8 lbs of seed should be sown in 500 square feet of nursery to get sufficient seedlings for planting an acre.

Transplanted plants give rise to onions big in size and of good quality.

Onion seeds loose their vitality very soon. Therefore only fresh seed should be sown.

Season.—They do best in the cold weather. Seed should be sown in the nursery in August and transplantation done in October. The seedlings are ready for transplantation when a bulb—like swelling is seen at the base of the seedling. The top portion of each plant should be cut away before transplantation. If the roots are very long it is advisable to prune them back a little.

When sugarcane is cultivated a catch crop of onions may be taken. The onions are transplanted on the sides of the ridges and are harvested before the cane is earthed up.

Irrigation.—The land should be irrigated a day or two before transplantation so that the seedlings may be easily inserted in the soil. The plots should be irrigated as soon as planting is done. Subsequent irrigation will be once in a week or 10 days according to the soil and climatic conditions.

Intercultivation.—Hand weeding and mulching of the soil are necessary 3 or 4 times during the crops growth.

After care.—Flowering shoots or "Scapes" which appear should be removed so that the bulbs may properly develop.

Harvesting.—The crop is ready for harvest when the leaves become yellow and fall down to one side near the neck of the onion. The onion

takes about 4 to 5 months after transplantation to be ready for harvest. Thebulbs are readily lifted by hand. They are sorted and cleaned. The roots are removed by means of a sickle.

Storing.—Onions should be first spread in the Sun for a few hours and then stored in a cool place in layers. They should not be heaped. In some localities the onions are strung together into bunches and suspended on horizontally tied bamboos.

Outturn.—15,000 to 18,000 bulbs are obtained from an acre.

Varieties.—Onions differ in colour, pungency, shape and size. There are the red, the white and yellow onions. They are either round or spindle shaped. Some are sweet while others are strongly pungent. Some varieties are naturally small while others produce big bulbs although the size depends on the method of planting and the amount of spacing given to the plant. The red varieties are considered to be more pungent than the white ones.

Raising of onion seed.—Well developed bulbs are selected. The top portions are cut away to allow the shoots to come out easily. The beheaded bulbs are planted in lines 12 inches apart and a spacing of 9 inches maintained between plants in the row. The bulbs are planted in well manured beds. Several flowering shoots spring up from each bulb. The flower heads are harvested when they are dry, and seeds collected. About 230 lbs. of seeds are obtained from an acre.

Labour requirements for some of the operations

PER ACRE

Operation.	Bullocks.	Men.	Women.	No. of days.
Preparation of 500 sq. ft. of nursery.	Nil.	5	Nil.	3
Watering the nursery.	"	Nil.	1	Full time till seedlings are ready.
Ploughing with a heavy iron plough.	2 pairs.	3	Nil.	2
Spreading 30 Cart loads of F. Y. Manure.	Nil.	Nil.	3	1
Bakharing.	1 pair.	1	Nil.	½
Preparation of ridges by means of a ridging plough.	1 pair.	2		⅓rd.
Mending ridges & cutting of inlets into kyaries.	Nil.	2	Nil.	1
Transplanting seedlings.	"	Nil.	22	1
Weeding.	Nil.	Nil.	6	1
Harvesting of bulbs.	Nil.	Nil.	20	1
Cutting of tops after lifting.	Nil.	Nil.	4	1
Cutting of tops of bulbs meant for seed production.	Nil.	Nil.	4	1
Planting of bulbs.	"	"	10	1
Collecting dry heads.	"	"	14	1
Threshing seeds.	"	"	8	1

Extracts

CULTURAL METHODS OF CONTROLLING PLANT DISEASES.*

BY RUDOLPH D. ANSTEAD, M. A., C. I. E ,

Since the day, sixty years ago, when the Madras Agricultural Department was born, views on many agricultural problems have undergone a profound change. This is especially the case in those branches of the subject which deal with the pests and diseases of crops. During the past fifty years enormous strides have been made in medical knowledge of all kinds, including the health of plants.

An incessant war is carried on between man and insects, fungi, and bacteria, and many are the methods which have been recommended to combat these pests which take an enormous annual toll of our crops and stored products, and also of life of man and beast.

Despite this, agricultural practices have been remarkably little influenced. It seems so obviously the right thing to ascertain the nature and life history of a pest and then to attack its weakest and most vulnerable phase. This, however, does not get to the real root of the problem, and in most cases is only a palliative. The hosts of the enemy remain, undiminished at their source, and the remedies have to be constantly applied. It is now being realised that direct attack by assault and battery is nearly always useless, and entomologists and mycologists are being rapidly transformed into plant pathologists, bringing these subjects into line with new developments of medical thought. A more insidious technique has begun to appear, which may be called perhaps the "cultural" method of preserving plants in health. The presence of the pest is ignored in this technique, and no direct attack is made on it.

In his Presidential Address to the Agricultural Section of the British Association at Toronto as long ago as 1924 Sir John Russel said "These cultural methods of dealing with plant diseases and pests offer great possibilities, and the close study jointly by plant physiologists of the response of the plant to its surroundings, and the relationships between the physiological conditions of the plant and the attack of the various parasites would undoubtedly yield results of great value for the control of plant diseases."

Mycologists and Entomologists are turning their attention more and

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more to the effects of soil and climate on the incidence of disease, and it is now becoming generally recognised that there are vast possibilities of controlling many plant diseases, not by attacking the disease organisms themselves, but by controlling conditions in such a way that the organisms are unable to develop because they find the conditions imposed deleterious to them. Though the organisms are present they are unable to become effective because the conditions are not favourable to them.

For example, MacRae pointed out that foot rot (Helminthosporium) of Wheat in Northern India occurs only on early sown fields, and the remedy is not to spray, but to delay sowing until the cold weather sets in, and the temperature imposes conditions unfavourable to the development of the fungus. This is a purely " cultural " remedy based on a study of conditions which favour the crop and are unfavourable to the disease.

It is well known that a plant or an animal, in good vigorous health is resistant to disease attack when subjected to infection. It is the plants or animals which are ill nourished and weak which fall easy victims. Hence the plant pathologist has in recent years turned his attention more and more to the study of the factors which maintain a plant or animal in vigour. When these are known it is often possible to provide for resistance when an epidemic of some sort, insect or fungoid comes along.

In 1924-25 the demonstration areas under cotton at Chendathur in the Fourth Circle were perfectly healthy, while all round the cotton on the ryots fields was attacked by " black arm " and looked as if a fire had been through them. All that had been done on our demonstration areas was to employ correct cultural methods. Dr. C. L. Withycombe dealing with the " frog hopper " pest of Sugarcane in the West Indies said that " canes do not necessarily show serious blight when frog-hoppers have been abundant, nor is an abundance of " the insect a necessary condition for serious blight " and he maintained that the controlling factor was often the presence of plenty of water physiologically available to the canes, a factor which could be arranged for. Again, cotton leaf-spot (Altenaria longi pediciliate) is a weak parasite able to infect weak tissue only under the most favourable circumstances, and yet in Trinidad when cotton is water-logged or has poor root growth it becomes a serious pest. (Empire Cotton Growing, Review. V. 1. 48).

Tunstall when reviewing Tea diseases aud their remedies (Quar

Jour. Indian Tea Association 1920) puts cultural methods, such as improved drainage, removal of excessive shade, and clean pruning, before direct methods like spraying, and work in Ceylon has shown that tea bushes which fail to recover after pruning and are attacked by Diplodia are really deficient in reserves of food. Wallace again, concludes that all the available evidence points to "leaf scorch," a frequent cause of loss to orchard growers, arises from defective nutrition and unsatisfactory water supply, cultural defects which can be remedied by drainage and manuring. (Jour. Pomology and Hort. Science (VII. 1 and 2).

Rotation of crops will some times prevent disease attack. A case in point is the Betel Vine in the Madras Presidency which when grown continuously on the same land is apt to become infested with Phytophthora wilt disease, absent when rotation is practiced.

Eelworm attack on Sugar Beet and Potatoes is a danger. In Germany in 1876 this pest became so widespread that twentyfour sugar beet factories had to be closed down. The remedy lies in rotation of crop. Beet should only be grown once in four years on the same land.

Another method is that adopted by the plant breeder who, in many cases has been able to evolve new strains highly resistant to particular diseases so that the actual presence of insects or micro-organisms may be ignored. One of the latest examples of this method is the evolution of a "blast" (Piricularia) resistant strain of paddy at Coimbatore. Many other examples could be quoted. The strains of wheat resistant to rust produced at Cambridge by Sir R. H. Biffin are world famous, whilst varieties of potatoes resistant to virus diseases, and Poplar hybrids resistant to canker are well known.

An interesting example in this direction is the case of apple scab. At one time it was thought that this fungus pest could only be controlled by constant spraying, but experiments at the East Malling Research Station in Kent (England) have shown that certain rootstocks induce resistance, while others induce susceptibility to the disease. Hence it is possible to select rootstocks on which to graft apples which will help the grower to ward off the scab disease by a cultural method, and spraying is then unnecessary, or at any rate more effective. It is of interest to note that trees which were well manured benefitted from spraying more than trees on starved land. On the latter the disease is apt to be so bad that any control is impossible.

The internal condition of the food plant in relation to insect attack is of importance. The association of particular species of insects with particular food plants has resulted in an adaptation on the part of the insect with regard to the physiology of its digestion in a manner best suited to requirements. Many insects fail to live on other than their normal food plants. The resistance or immunity of a plant to insect attack is often due to factors closely associated with the physiology of the plant, probably the presence or absence of particular substances in the tissues of the plant. Thus Andrews showed that the vitality of Helopeltis, the "mosquito blight" of Tea is directly controlled by the suitability or otherwise of the food supply, and when a constant supply of soluble potash is applied to the roots of the tea bush it will remain immune from attacks for a long time.

Sugar Beet develops a specific disease in the absence of Boron. Oats suffer from a grey fleck disease in the absence of Manganese, though only one part in a million may be necessary to prevent this. Zinc appears to be essential for fruit trees which are otherwise attacked by rosette disease.

This leads to the question of vitamins which have been found to be so essential to the health of animals and man. Pioneer work carried out by the Madras Agricultural Department by Lt. Col. McCarrison, Viswanath, and others has indicated that there is a relationship between the supply of vitamins and the organic content of the soil, and has emphasised the importance of maintaining the humus content of soil, (Mem. Dept. of Agri. in India, Chem. Series. IX. 27. Indian Jour. Medical Research, IV. 4.)

The plant apparently obtains vitamins from the organic matter, possibly directly, and these vitamins are handed on to the animals which feed on them. The author would suggest that it is within the bounds of possibility that the vitamins are just as important to the health of the plant as they are to the health of the animals, and that it is not likely that the plant is merely acting as a transferring medium for these essentials of health. There is a growing mass of evidence to prove that when the humus content of the soil is allowed to run down below a certain level crops become increasingly subject to diseases of all kinds. Hence the importance of the use of organic fertilisers like Activated Composts.

Sir Albert Howard claims that in another fifty years time all plant diseases will be dealt with along such lines as have been here indicated,

and that spraying machines and the like will only be found in museums. Though the author is not prepared to go quite so far as that, he does maintain that in the future more and more attention will be devoted in the campaign against plant pests and diseases to the cultural method of attack rather than to the stock attack of the sprayer, and he trusts that the Madras Agricultural Department, which he had the honour and privilege at one time to serve, will be found at the end of the next fifty years in the forefront of the battle in the same proud position which it has occupied since the day it was founded.

CAULIFLOWER CULTIVATION IN THE TROPICS.*

BY R. CECIL WOOD AND H. M. JAMES.

The successful cultivation of cauliflowers in the West Indies does not merely imply the addition of a new and palatable vegetable to a tropical diet. From the experience gained at the College Farm during the past year, it seems likely that they could be produced on a considerable scale for export purposes. The crop is not a difficult one to grow, though it requires careful treatment; it possesses a high value and seems to stand cold storage well. It would be a suitable crop for peasant cultivation, if marketing facilities could be arranged.

The success of this crop has only recently been made possible by the use of Indian—grown strains from that famous house of seedmen Messrs. Sutton and Sons, under the name of 'Pattna' and 'Benares' strains. The strain used in the present case was that known as 'Early Patna'. The origin of these strains, as kindly explained in a letter from is the firm, uncertain, but it seems likely that the Patna strain was a selection from their well-known 'Improved Snowball', acclimatised and selected for some years in India. Other Sutton's strains which are reported to be satisfactory are 'Main Crop Patna' and 'Early and main Crop Benares' in British Guiana and 'Early Market' in Barbados. No other strains have, as far as the writer are aware, been successful in the Tropics.

Season.—The seasonal limits of this crop have not yet been defined. On the College Farm this season, cultivation started with the sowing of the first seedbed on 10th September, and seedlings from this sowing were planted out on 30th September. Planting was more or less continuous from then until 1st February when the last portion of field 6 was planted. The table below gives some relevant meteorological figures.

* Jour. of the Imperial College of Tropical Agriculture, August 1936. Vol. XIII. No, 8.

TABLE I.

Average of Seven Years.

Month.	Rainfall.	Temperature Average Maximum	Temperature Average Minimum	Average Minimum Humidity.	Average Hours Sun—shine
October.	7.38	87.0	71.7	63.0	6.80
November.	7.34	83.1	71.1	65.2	6.66
December.	5.97	84.3	69.6	62.6	6.99
January.	2.62	83.7	67.1	57.7	7.23
February	1.05	84.0	66.3	53.1	8.05
March.	1.52	85.7	67.6	51.8	8.20
April.	1.43	87.0	70.5	52.4	8.50

It is apparent that without facilities for irrigation, it would not have been possible to plant out much later than 1st January. Even with irrigation, it is likely that the temperatures in late April and May are too great for the crop, though early showers towards the end of May might cool the land down sufficiently to get a crop through before the heavy rains of July. A long close season however, is desirable in order to cope with the insect pests that attack the crop.

Sowing.—The seed, which is small, is sown out in beds or boxes in which it remains for about ten days, by which time the young seedlings are ready for pricking out into three feet beds, where they are spaced about four inches by four inches. Here they remain in for a further three weeks, when they should be about six inches in height. It has been found that light shade is beneficial to the young seedlings, and, by encouraging quicker growth saves time in the nursery. The seedlings will not all be ready together, but after about four to five weeks from the original sowing, some should be ready for planting out in the field The spacing adopted here is two feet by two feet. There is no peculiarity in the planting, though there is perhaps a tendency to plant, the seedlings too deeply. Supplying will always be necessary and is often heavy.

Manure.—As for all vegetables, the land should be in good heart and the crop will take any quantity of organic manure. It will be noticed that an excellent yield was obtained from field 13B, which was an old corner on which had been stacked a large pile of pigeon pea (Cajanus) stalks for some months previously. Under this heap had accumulated a quantity of organic matter in the shape of fallen leaves, buds and broken twigs. Good results should be obtained from a dressing of 20 tons per acre of good Pen Manure, along with two cwt. Blood Meal, one cwt. S/A, and adequate supplies of potash and Phosphoric Acid.

There is little to say about the subsequent cultivation of the crop. Weeding will be necessary, but it should not be long before the plants begin to close over and then the main business will be to deal with the insects that attack the crop, of which the worst is Hellula phidilealis. This pest was studied by one of us, and a note on its life-history and the measures found successful in dealing with it, are given below. It must be emphasised that unless this pest can be controlled, *the cultivation may be a complete failure.*

As the flowers begin to form, it may be worth while to skewer three or four leaves together to shade the flowers, in order to preserve the white colour which is desired. The operation is simple, and the thin midrib of the coconut leaflet, such as is used to make brooms, is found quite efficacious. It will be seen that the plants form heads very irregularly, and while a few will be found seven or eight weeks* from sowing, the heads formed so early are very small and hardly marketable. Good cauliflowers will begin to appear from 9 to 12 weeks from sowing (three to six weeks after planting out), and will be ready for cutting at 13 to 16 weeks of age.

Heads should, if possible, be cut the day they ripen, for faults soon appear if harvesting is delayed. Over-mature heads tend to separate and become loose. A slight elongation of the ultimate branches causes the condition known as 'riciness', and such heads, though they may not suffer in taste, are objectionable in appearance. With the advent of drier conditions, a certain number of deformities will be found; heads become small, and are often fuzzy in appearance, owing to the elongation of the individual flower-stems. Small-sized heads may also result from planting over-mature seedlings from the seed-beds.

The average weight of heads will be seen in the table below, and is a pound or a little over. Some very fine specimens weighed as much as 4 lb., in a closely-trimmed condition.

Cauliflowers are sold by weight, and it is understood that the outer leaves must be removed and the inner leaves trimmed level with the surface of the flower. When heads are to be sent to cold storage, it is found better not to cut the leaves, but bend them over the heads, in order to reduce desiccation.

Economics.—In the table below are set out the yields of the four plots in which this crop was grown in the past season on the College Farm.

TABLE II

	Area acres.	No. of seedlings planted out.	Heads harvested.	Percentage.	No. of heads per acre.	Wt. per acre lb.	Av. Wt. per head lb.
F. 6	.62	6,534	2,125	35	3,427	3,598	1.0
F. 13B	.04	540	291	54	7,275	8,175	1.1
F. 16A	.06	700	419	60	6,980	9,330	1.3
F. 34	.25	2,722	301	11	1,204	1,147	.9

Fields 13B and 16A were both planted early (October) and enjoyed good growing weather although they were probably the worst attacked by the Hellula caterpillar. Field 6 was on a larger scale, and was planted in January, the weather became dry as the crop matured, and it had to be irrigated. Field 34 was further away from the steading, and was on a plot which was found to be of much less fertility than had been thought. It did not receive so much attention, suffered severely from cut-worms, and was at one time almost abandoned.

The yields given above are the yields of saleable heads, and the crop was sold at a price of 20 cents per lb, retail, and 16 cents wholesale. At this price, there has been no difficulty in disposing of the whole crop of over 3,000 cauliflowers in the season from December to April.

Reference has been made to the storage of a portion of the crop for experimental purposes, and the first results obtained were recorded in

Tropical Agriculture, XI, 199. Subsequent experiments indicate that desiccation can be largely prevented by folding uncut leaves over the flower, and that there would be no difficulty in holding cauliflowers for sale for periods up to 40 days.

Insect Pests.—Soon after planting it was noticed that the young plants were being severally attacked by a small caterpillar which ate into the central bud, and caused severe distortion, frequently resulting in death. A careful study of the life-history of this caterpillar was made, as it was evident that unless it could be controlled, there was little prospect of success. It was difficult to identify, and it was only after a number of young plants had been transplanted into pots and kept in cages, that the moth was observed and identified as Hellula phidilealis.

The life-history of this pest is as follows. Eggs are deposited on any portion of the leaf, but mainly on those portions facing uppermost. They are very difficult to see, being small (1/50 to 1/25 of an inch in length) and of a greyish colour when first laid, changing to a reddish brown just before hatching. The egg-stage lasts four to six days. The larvae start eating the leaf-tissue at once and are completely inside the leaf within two hours of hatching. They remain inside the leaf for about four days, sometimes longer (*i. e.* until they are about ¼ inch in length), and then move down the stem and begin to attack the bud. They are soon inside the bud and cover themselves with a web, their presence being easily noticed by the large amount of frass deposited outside the tunnel. The larvae possess a characteristic brown pattern on the back of their bright yellow bodies. After 15 days in the bud, during which time the larvae grow to about ¾ inch long, they emerge from the same hole by which they entered, move down the stem and, a few inches away from the plant go into the soil where they bury themselves and begin to pupate. The larvae forms a small, smooth-walled chamber for itself and is transformed into a pupa that is about ¼-inch long, and brown in colour. The adult moth emerges in 11 days and is small and silvery-coloured, having a wing-spread from tip to tip of about ½-inch, and body length of not more than ¼-inch.

Life History—

Egg stage-4 to 6 days.

Larval stage-19 to 20 days.

Pupal stage-10 to 11 days.

The pest has been noted before and is reported to feed only on cruciferous plants. From the heavy infection which appeared on the first-planted seedlings, it was evident that the pest was about in large numbers, but search failed to reveal any cruciferous weeds, nor was the pest found on the Capparidaceous weeds which were plentiful in the neighbourhood. Attention at this stage was called to the cultivation of Brassica sinensis, the Chinese Cabbage or 'Patchoi', which was commonly cultivated in the vicinity and on which the pest was found in large numbers. It is as well to emphasise that no other Cruciferaė, such as Cabbage or Radish, should be grown, and that there should always be a fairly long close season before the start of the cauliflower crop.

Opportunity for dealing with the pest seemed slight, owing to the brief time that it is vulnerable,—from the time when it crawls down the leaf where the egg is laid, to the bud, the period being two or three hours—before it is hidden and protected by a web. Hand-picking was at first resorted to, but this was laborious. The use of a spray was recorded in the Philippines, and a mixture of five spoonfuls of lead arsenate in a kerosene tin (four gallons) of water was found to be effective. Dusting with Paris green and lime in the ratio of 1 : 16 has been found more effecient, for spraying is difficult on account of the habit of the plant, and the waxiness of the leaves, which necessitates the addition of an efficient sticker. Also, to be effective, spraying must be done at least twice a week, while in the dry weather the dust remains effective for a much longer period. It is of course obvious that the use of poison must be discontinued before the heads begin to form.

Continuous hoeing results in the destruction of large numbers of pupae in the soil. Affected plants should be removed at once and destroyed, and the site of the plant should be hoed. The attack is naturally more severe when the plants are young; in older plants the caterpillar seems to bore into the the bases of the larger leaves rather than into the bud.

Gleanings

Milk from newly-calved cows.—The milk of the newly-calved cow is abnormal and is called colostrum or beastings. It is yellow in colour has a rather strong pungent taste, an unpleasant odour, a sickly albuminous flavour, a high specific gravity, high total solids, high albumen, and low figures for fat and sugar. The fat of colostrum has different properties from that of normal milk, and the sugar is largely glucose and not lactose—it also shows a larger proportion of phosphate than normal milk. Such milk serves only as food for the new-born calf, and not as a means for increasing the supply to the factory. Besides serving as food for the calf it also increases the resistance of the calf to disease during the first few days of its existence. The milk becomes more normal day by day until, in seven days after calving, it is practically normal although it may take up to a fortnight to attain perfect normal composition, It is advisable to isolate the newly-calved cows, and for the first seven days at least this colostrum milk should not be mixed with normal milk. either for butter or cheese. Cream from such milk blended with good cream results in the whole delivery being graded down either to second grade, or in being completely rejected. Therefore, do not separate this milk on any account. Colostrum milk is quite unfit for cheese-making, since it is easily coagulated by heat, curdles very slowly with acids and rennet, and results in very poor quality cheese.

Therefore, remember (1) colostrum milk is food for young calves only; (2) it should on no account be sent to cheese factories or as cream to butter factories. (*Queensland Agri. Jourl.*)

Growing plants without soil.—Thanks to Dr. W. F. Gericks, the pioneer in plant nutrition of the University of California, growers in Los Angles and California are successfully growing vegetables and berries in nutrient solutions, heated by electricity. Electric heating cables run under the bottom of vats. A mesh wire layer covers the top on which litter is spread to serve as seed-bed and insulation against heat-loss. The plants or seeds are placed on the bedding; and kept moist by the water in the vats. As a result of growth, the roots descend into the water when the necessary chemicals are added to the water in the right proportions. The electric cable keeps the solutions at the required temperature. Success has been reported in the case of tomatoes, sweet-peas and straw-berries. The tomatoes come to harvest earlier than 'soil grown' ones, the

yield large, the quality better and hence the premium on the market price higher. Dr. Gericke is expanding the use of this technique to the growing of tobacco, cucumbers, papaya, and other floral crops. (*Scientific American, October 1936*).

A new and cheap method of rinderpest control.—In the past the control of rinderpest has been a somewhat difficult matter demanding strict quarantine and careful regulation of dosage, under close veterinary supervision to ensure that virulent rinderpest was not spread and that the immunity conferred by the serum-simultaneous method was a lasting one. Moreover measures had to be taken to control mortality from inter-current disease brought on by severe reactions to the virus. As a result of research, which has been in progress at the Imperial Institute of Veterinary Research, Muktesar, for a number of years, a vaccine has however now been evolved, from inoculated goats, which is of such reduced virulence, on indigenous cattle, that it can safely be used without serum and without danger of spreading disease. This vaccine can therefore be freely used for the control of outbreaks of rinderpest or to confer lasting immunity. The principal involved in the use of this vaccine is very similar to that which the public has become familiar with in the control of small-pox by vaccination with calf lymph. The reaction caused by such vaccines, though mild, is sufficient to confer lasting immunity against more virulent infection. Tests of this new method of anti-rinderpest vaccination, carried out on a very extensive scale in different parts of India, have been universally satisfactory. Thus the control of rinderpest has now become a comparatively cheap and easy matter. Previously, it was necessary to employ, at considerable expense large quantities of serum, either alone or along with a dose of virulent blood obtained from the cattle. Moreover, the immunity conferred by serum alone was a purely temporary one, usually lasting about 10 days, and in the case of serum-cum-virus there was always a danger of considerable mortality if the dose of serum was insufficient. Conversely, if the dose was too big a satisfactory reaction was not obtained. With the method of vaccination now advocated these difficulties are obviated and the vaccine is so cheap that, given the necessary vaccinating staff, the cost of its application in the field is almost negligible. Further the local preparation of vaccine in a properly equipped provincial laboratory is quite feasible and this is the procedure recommended. A point has therefore been reached where, with an adequate organisation for carrying out immediate inoculation, there should be no difficulty in bringing

rinderpest under satisfactory control, throughout India, at very moderate expense. (*Agriculture and live stock in India*).

Land reclamation in Italy.—One of the achievements of which Italy can unreservedly be proud is the reclamation of large areas of land that for centuries remained marshy. An idea of the vastness of the operations and their popularity may be guaged from the following figures :—

Labour employed.	18 million, man days.
Area reclaimed.	47 million, hectares (2,47 acres)
Increase in out put.	·2 Million metric tons (2,000 lbs)
Fall in imports %	about 80.0

Of much greater interest perhaps to this country is the way in which the Italian Government tackled what is known as the "Southern Question" consisting of a group of problems arising out of the backward economic and social conditions of South Italy. The general machinery is prescribed by the Mussolini Act which characteristically does not lose itself in the maze of existing measures. It leaves them as they are and goes straight forward. Financial provision of 7000 million lire is made to be spent in the course of 14 years. Half of this amount is chargeable to the treasury and the remainder to the land owners. The major part of the finance is provided to the parties concerned in the form of 30 year annuities discounted to them by different institutions. The scheme aroused such great enthusiasm that applications for funds were so numerous that the alloted sum was found far too small to meet them all. Preference was given for the execution of the work of public bodies which ensured a certain minimum of private initiative. Private rights were acknowledged and when curtailed, were said to be adequately but not excessively compensated. A special section of the Ministry of Agriculture which receives proposals and itself draws up plans, deals with land reclamation and no project is accepted unless it shows considerable possibility of securing notable improvements in hygiene, demographic, economic, and social conditions. The plan being accepted by government the land owners proceed to execute the works either by themselves or through the consortium. They may provide all the money themselves or obtain government grants or special loans from the agricultural bank. When the reclamation is completed, some internal migration and land settlement becomes necessary. A special commissariat like the "Ex-service Men's League" attended to this and the migrants were drawn mainly from farm workers brought from more densely settled regions.

The system adopted was as follows :—The reclaimed land is cut up into holdings of 25 to 75, acres according to the quality of land, each furnished with a house, stabling for ten cattle, poultry run, pig sty, well etc. The farms are taken by the immigrants first on a crop sharing basis the tenants receiving monthly advances in the shape of supplies and cash allowances from the League or other societies. When the head of the family gets experienced, an agreement is drawn up under which he will purchase the farm and the livestock from the League in 15 annual instalments covering capital and interest which varies in general from 200 to 630 lires (9½) per hectare as cost of upkeep and amortisation of the drainage work. These repayments do not cover the government contribution. *(The Madras Agricultural Journal, Vol. XXV, No. 1, Jauuary 1937)*

Development of the cotton hair.—On this subject, Dr. F. M. I. Sheffield has recently published a note of considerable interest (*Empire Cotton Growing Rev., 13, No. 4; 1936*). This note makes it clear that a state of affairs exists in the outer coat of the developing cotton seed in the early days following fertilization, which has not been sufficiently considered when attempts are made to generalize on these developmental processes. As growth proceeds in the expanding ovule, naturally cells of the spidermal layer continue to multiply and divide, but these dividing cells are interspersed among other cells or cell groups, which are rapidly expanding into hairs, so that fully differentiated and meristematic cells are ultimately interspersed. Dr. Sheffield directs attention to this unusual state of affairs and contrasts it with the apical meristem or the cambium, though it will be recalled that in the cambium there are usually ray cells interspersed between the long cambium initials which are clearly in a different state of differentiation. Hair production in early stages of leaf development is probably also associated with similar appearances in the epidermal sheet. Dr. Sheffield concludes that the amount of variation, associated with hair development, occurring from cell to cell of a single seed and from seed to seed within a single boll is greater than the differences in development between varieties or even between old and new world types of cotton. Cell divisions were seen in the epidermis of Sakel cotton seeds up to the tenth day after pollination and probably occurred later than this—but the general trend of these observations is to minimize the significance of the exact length of time for which cell divisions were seen and to stress the great variety of condition of cell development to be found over the surface of the seed. (*Nature, Decr, 19, 1936.*)

Imperial Agricultural Research Institute New Delhi.—An event of outstanding importance to the progress of Agricultural Research in India is the transfer of the Agricultural Research Institute from Pusa to New Delhi. As a consequence of the damage done to the Phipps Laboratory at Pusa by the severe North Bihar Earthquake in January 1934, the decision was taken to move the Institute to New Delhi. Instances of wholesale transfers of big Research Institutes like the Imperial Agricultural Research Institute are rare in the annals of research institutions, not only in India, but also elsewhere in the world and the authorities of the Institute have to be congratulated for the efficient manner in which they have handled the numerous difficult problems that must have beset them in this gigantic task. Their task was rendered all the more difficult by the unusually early break of rains in North East India and the floods both in Bihar and Delhi which was a feature of the monsoon of 1936.

The Imperial Institute of Agricultural Research at Pusa was inaugurated 30 years ago and with the progress of time became famous in India and abroad as the 'Pusa Institute'. The Institute holds a proud and enduring record of achievements in the science and practice of agriculture. The transfer has enabled the location of the Institute now renamed "Imperial Agricultural Research Institute, New Delhi" at the Imperial Capital, which is easily accessible to provincial agricultural officers, members of the Central and Provincial Legislatures, non-official visitors and visitors from abroad. The foundation stone of the Library Building was laid by H. E. Lord Willingdon on the 19th February 1935 and the Institute was declared open by H. E. Lord Linlithgow, on the 7th November.

The total area of the Institute is about 800 acres, of which about 275 acres are under buildings and pasture and the rest is agricultural land which has been laid down into fields for experiment and research. The buildings comprise a Students' Hostel, providing accommodation for 24 students, separate blocks for the agricultural, botanical, chemical, entomological and mycological sections and a spacious central building for the Library designed to accommodate two lakhs of volumes. The agricultural section situated towards the western boundary of the Institute, consists of two sets, one including a dairy cattle byre with modern fittings, a veterinary dispensary, etc., devoted entirely to the maintenance and development of the pedigree Sahiwal herd. The other

set of buildings consist of bullock byres, godowns, a workshop, etc., The main farm area is 475 acres in extent in a compact block for cultivation and field experiment.

In the botancial section, laboratories have been provided for researches in physiological botany and cytology. In the chemical section, a laboratory has been equipped for carrying out small-scale investigations on the utilisation of agricultural wastes and products and for devising ways and means for the production of intermediate products from agricultural produce. The necessity for such a laboratory was recognised fifteen years ago by the Board of Agriculture in India. The other features are the provision of a laboratory for nutritional studies relating to the differential composition and nutritive value of the different types of crops and the effect of soil conditions and treatment on the composition and nutritive value of cultivated crops. In the Entomological section facilities have been provided for the study of parasitology. In the Mycological section, there is a large insect proof house, part of which consists of glassed incubicles for carrying out pot culture experiments.

Post-graduate work at the Institute at Delhi will be carried on with the object of stimulating advanced research in agricultural sciences. The Government of India have recently issued orders that those who have satisfactorily completed the course in any of the subjects, or who may do so in future, will be regarded as Associates of the Imperial Agricultural Research Institute and may affix to their names the abbreviation "Assoc. I. A. R. I.". (*Current Science, Vol. V, Decr. 1936*).

Guide to Punjab Government Reports.—In accordance with their policy of issuing reports of general usefulness in addition to strictly scientific publications which are of value to a relatively small number of people the Punjab Board of Economic Inquiry have in preparation a "Guide to Current Punjab Official Statistics." There is available in the annual reports of the various Government Departments an immense amount of useful information of which the public is largely ignorant. In this Guide the latest issues of these reports, of which there are about forty, will be dealt with. Each report will be treated separately; first a general description of the contents of the text of the Report will be given and then the subjects contained in the annual statistical tables will be presented alphabetically and references given to the tables and the specific columns in which they are dealt with. It is expected that the

Guide will be useful not only to Government officials and to the new Punjab Assembly members, but also to businessmen, professors, students and the reading public in general, since everyone requires statistics on some particular topic at one time or another but does not know exactly where to get them. It is hoped that the Guide will be available early in March next.

Current Research.

Mineral matter in the juice of sugarcane and its effect on the recovery of white sugar, I.—by P. E. Lander and R. Narain, (*Ind. Jour. of Agri. Science* Vol. VI page 1218, 1936) Sugar refineries in the Punjab have always shown a preference for gur or jaggery from the United Provinces over the local commodity, on the plea that the former yields a greater percentage of white sugar. It was at one time believed that the smaller recovery of cane sugar from Punjab gurs was due to the defective method of their preparation, resulting in the breaking down into smaller fragments of the larger-sized crystals of sucrose by constant ladling and stirring of the juice and the thickened syrup as practised by the Punjabi gur boiler—an obviously unacceptable explanation. It has, however been found that the low recovery is due to the greater amount of mineral matter present in the Punjab gurs, which is the result of the high ash content of the cane-juice from which these are prepared. Apart from the higher ash content of their juice, the Punjab canes are in no way inferior to those from the United Provinces and Bihar; they contain as much sucrose as those from the two latter provinces and much less glucose. Since all mineral matter in plants and crops is derived from the soil on which they grow, the high mineral content of the juice from the Punjab canes must be correlated with the composition of the Punjab soils. It has been shown that in mechanical composition and the nature and amount of their water-and-acid soluble salt content, the sugarcane soils of the Punjab are almost identical with those from the other two provinces, but they differ in the amount of exchangeable calcium. This in conjunction with a slightly higher pH value seems to be the most likely explanation of the greater ash content of the juice from sugarcane grown in the Punjab. It is suggested on the analogy of the wheat plant that it may be possible to modify the ash content of the cane juice by treatment of the soil with certain chemicals and manures. Experiments with this object in view are in progress at different centres in the province and the result will be communicated when ready.

The problem of the Nitrogen supply of rice: 1 Fixation of Nitrogen in the Rice soils under water-logged conditions.—by Pran Kumar De, (*Ind Jour. of Agri Science* Vol. VI. Page 1237,1936). Several rice-soils collected from different parts of India were studied with regard to their power to fix nitrogen under water-logged conditions. Fixation of nitrogen took place in all of the soils examined, when they were water-logged and exposed to sunlight for three months. Soils having slightly alkaline reaction fixed much more nitrogen than those with lower pH. In the former soils, a heavy algal growth appeared soon after water-logging but in the latter the growth was much poor. The additon of calcium carbonate to the soils having acid reactions stimulated both algal growth and also nitrogen fixation. It has been shown that bacteria fix more nitrogen in the dark than in presence of sunlight. From the evidence available, it is concluded that the fixation of nitrogen in water-logged soils is an algal process, though it has not yet been possible to decide whether the fixation is brought about by algal alone or in symbiosis with other organisms.

Blight and Hollow-stem of sorghum by B. N. Uppal and others (*Ind Jour. of Agri. Science* Vol. VI. Page 1323, 1936) Macroyhomina phaseoli is shown to be responsible for a seedling blight and hollow-stem of jowar, a disease which is new to the Bombay Presidency and has not so far been reported elsewhere. The disease in common on bhata soils in Broach and on medium black soils in East Deccan The fungus enters the plant through feeding roots and ascends the stem and may be traced up to the ear-head. There is no external evidence of the disease until the plant approaches maturity. At this time infected plants are found to have hollow stalks and produce a characteristic sound as they are forcibly shaken by wind; hence the disease has been given the name "hollow-stem". Seedling blight is also common and may become very destructive under the conditions of high soil-temperature and high soil-moisture content. The fungus normally forms sclerotia, but Mohol strain of the fungus also produces the pycnidial stage on jowar seedling grown in Roux tubes. The disease is most active at high soil-temperature (35° C.) and high soil-moisture content, thus confirming the general experience that infection in rabi jowar follows periods of heavy rains and high temperature. The disease is more common in clayey soils than in silt loams. The morphology and cultural characters of the causative organism have been described.

The decomposition of organic matter in relation to soil fertility in arid and semi-arid regions.—by P. C. J. Oberholzer, *Soil Science*, Vol. 42, page 359, 1936

Aqueous 1:5 extracts on three Calcareous soils rising three types organic matter brought out the following facts. Decomposing organic matter has no significant influence on the pH of calcareous soils. Over and above its own phosphorus content, organic matter does not affect the availability of phosphates to any appreciable extent. The influence of organic matter on soluble salts and nitrates depends primarily on its chemical nature, especially its C:N ratio. The slow rate at which manure is nitrified is regarded as a distinct advantage. Percolation studies led to the conclusion that during the first few weeks active decomposition results in large increases of soluble salts, especially calcium bicarbonate. After six weeks had elapsed, however, the difference between treated and untreated soils was negligible. Alfalfa, hegari and manure decompose in the order mentioned when CO2 production from soils is taken as an index to rates of decomposition. Larger amounts of CO2 are produced than are reported for humid regions, and maximum production always occurs during the first or second day. Glucose, lignin, Cellulose, and starch undergo decomposition in the order mentioned when incorporated with a soil and when rates of decomposition are estimated by CO2 evolution. Explanations are suggested for the relatively rapid rate at which lignin decomposes, and attention is directed to the significance and importance of this pheno menon. The rate at which organic matter decomposes increases with increasing moisture up to almost complete saturation. However, considerable losses occur even below the wilting coefficient, and it is suggested that the microbial flora has shifted to the left, the cardinal points with respect to moisture, approaching a xerophytic flora. Decomposition of organic matter increases with temperature, the maximum being around 45°C as found by CO2 production from soils. Although microorganisms are sensitive to low temperatures, adaptations are possible, allowing them to function over a relatively wide range of temperature conditions. It is suggested that in the case of temperature, the cardinal points have been shifted to the right, approximating a thermophilic flora. If appears that temperatue is a more important factor than moisture in the decomposition of organic matter, but obviously a combination of the two is the actual criterion. The bulk of the CO2 produced by microbial action does not remain in the soil, but is returned rapidly to the atmosphere, without seriously affecting the relatively stable conditions existing. Fractionation of organic materials at different stages of decomposition shows that in general the trend is the same as that reported by other investigators. But it appears that there is a more rapid disappearance, that the water soluble fraction is maintained at a higher level, and that

the lignin and protein complexes suffer appreciable losses by microorganisms. In the presence of soil, organic matter under-goes essentially the same trend of transformation, with the exception that the carbohydrate fraction tends to disappear somewhat more rapidly. This results in a more pronounced relative accumulation of lignin and proteins. Neubauer investigations showed that actively decomposing organic matter is injurious to the growth of seedlings. It further appears that organic matter affects the availability of phosphates only to the extent of its own content of phosphate but markedly increases the availability of potassium from the soil.

Studies on the organic nitorgen of paddy soils. Part I Distribution of 'humic' and 'non-humic' nitorgen in organic matter.—P. K. De and A. K. Pain, (*Ind. Jour. Agric. Sci.*, 6,1081). The paper describes the results of an examination of the organic matter of the paddy soils, with regard to the solubility of the organic nitrogen in cold, dilute alkali and the distribution of the humic and the non-humic nitrogen in the alkali extracts. Altogether thirteen soils from different parts of India were examined and the average distribution of nitrogen in the organic matter is as follows : Nitrogen extracted by direct acid treatment—3 per cent, alkali insoluble nitrogen—56 per cent, non-humic nitrogen-33 per cent, humic nitorgen-8 per cent. The organic nitrogen is much less soluble in baryta and sodium carbonate than in caustic soda. There is evidence to suggest that the non—humic nitrogen compounds do not remain entirely incorporated in the humic-cley gel. *Authors' abstract*).

The locust incursion of 1935 in North-West India-Its significance in the study of the locust problem.—Y. Ramchandra Rao. (*Ind. J. Agri. Sci.*, 6,1031). Locust swarms were found in most districts of North-West India during the years 1926 to 1931, but very few were noted since December 1931. During the years 1932 to 1935, although swarms were not to be seen, specimens of locusts in a non-gregarious or solitary condition were found in larger or smaller numbers in many of the desert areas of North-West India, chiefly in certain sandy patches covered with shrub vegetation, known as "reks" along the Mekran coast of Baluchistan, and also in many part of the sandy "desert" areas of the Sind-Rajputana Desert. Their breeding was, moreover, found to be entirely dependent on the occurrence of seasonal rainfall. In July 1935, a large and sudden increase in the numbers of locusts was noted in a great many places in Sind, Rajputana and the Mekran Coast which was traced to a widespread incursion of locusts coming from a

western direction, possibly from the interior of British and Persian Mekran. As the entry of locusts in the form of swarms had not been noted in most places, the locust incursion is presumed to have taken place in the form of a migration of solitary individuals. As this matter raises the question as to whether the solitary individual is capable of migrating long distances, the evidence collected on this point is discussed. A study of the fluctuation of locust population during successive months for a period of four years at Pasni and Ambagh, a study of the distribution of locusts during the different parts of the year 1935 and a biometrical examination of locust collections at Pasni during 1935 have all indicated the probability of the existence of seasonal migrations of solitary individuals. At the same time direct evidence of such migrations was obtained by actual observations made on high flights made by locust individuals and by recoveries of marked locusts. As to the origin of the wide spread incursion of July 1935 the writer is inclined to think that it must have originated in cases of incipient swarming brought about by the concentration in the hinterland of Baluchistan of individuals bred on the coastal 'reks' in the wake of the early and plentiful winter rainfall of 1935. Three cases of such swarming reported from different localities in the interior of Baluchistan are described. It is also recalled that similar outbreak centres had come into existence during the year 1923 and 1926 in Dasht and Kulanch repectively. The significance of these two points, viz. migration among the solitaries and the occurrence of incipient swarms, in the origination of fresh cycles of infestation of Schistocerca gregaria is pointed out. (*Author's abstract*).

Crop Forecasts

1936-37

COTTON

Third Cotton Forecast

All India.—This forecast is based upon reports furnished by the undermentioned provinces and states, which practically comprise the entire cotton area of India. It deals with both early and late varieties of cotton and relates generally to conditions upto the beginning of December 1936. The total area sown amounts to 23,901,000 acres, as against 24,130,000 acres at this date last year, or a decrease of 1 per cent. The total estimated yield is 5,478,000 bales* of 400 lbs each, as compared with

* The total quantity of cotton pressed up to the 18th. December 1936, during the current season (as far as reported) is given to the appendix to this forecast. The amount of loose (impressed) cotton consumed in Spinning Mill's in India during are also given in the appendix.

5,369,000 bales (revised) at the corresponding date last year, or an increase of 2 per cent. The present condition of the crop, on the whole, appears to be fairly good. The detailed figures for the provinces and states are shown below (the figures for the previous years are given in the appended statement).

Provinces and States.	Area.	Outturn.	Yield per Acre.
	Acres (thousands).	Bales of 400 lbs. each (thousands).	lbs.
Bombay (a) ...	5,428	1,093	81
Central Provinces & Berar. ...	4,041	825	82
Punjab (a) ...	3,685	1,383	150
Madras (a) ...	1,982	412	83
United Provinces (a) ...	694	173	100
Sind (a) ...	962	423	176
Burma (a) ...	500	100	87
Bengal (a) ...	75	26	139
Bihar. ...	31	6	77
Assam. ...	36	13	144
Ajmer-Merwara. ...	34	12	141
North-West Frontier Province. ...	19	4	84
Orissa. ...	(b) 6	(c) 1	67
Delhi. ...	2	1	150
Hyderabad. ...	3,025	493	65
Central India. ...	1,288	174	54
Baroda. ...	855	149	70
Gwalior. ...	619	94	61
Rajputana. ...	541	74	55
Mysore. ...	78	13	67
Total	23,901	5,478	92

(a) Including Indian States. (b) Repeated from second forecast later information not being available. (c) Provisional estimate.

On the basis of these figures, the average outturn per acre of the present crop for All-India works out at 92 lbs. as against 89 lbs. at this time last year. A statement showing the present estimates of area and yield according to the recognised trade descriptions of cotton, as compared with those of the preceding year, is given below.

Descriptions of cotton.	Acres.	(Thousands)	Bales of 400 lbs. each (thousands.)	
	1936-37.	1935-36.	1936-37.	1935-36.
Oomras :				
Khandesh.	1,274	1,284	267	282
Central India.	1,907	1,864	268	294
Barsi and Nagar.	1,935	2,401	340	437
Hyderabad-Gaorani.	834	937	140	140
Berar.	2,786	2,911	572	522
C. P.	1,255	1,318	253	224
Total.	9,991	10,715	1,840	1,899
Dholleras.	2,391	1,828	468	359
Bengal-Sind :				
United Provinces.	694	597	173	196
Rajputana.	575	(a) 524	86	(a) 95
Sind-Punjab.	2,501	2,420	915	886
Others.	43	43	9	9
Total.	3,813	(a) 3,584	1,183	(a) 1,186
American :				
Punjab.	1,638	1,445	664	587
Sind.	529	372	232	150
Total.	2,167	1,817	896	737
Broach.	1,438	1,352	324	297
Co-ompta-Dharwara.	1,087	1,288	165	184
Westerns & Northerns.	1,368	1,917	151	251
Cocanadas.	152	155	26	27
Tinnevellies.	311	344	80	(a) 89
Salems.	149	126	29	25
Camdodias.	417	415	168	170
Comillas, Burmas and other sorts.	617	(a) 589	148	145
Grand Total.	23,901	24,130	5,478	(a) 5,369

(a) Revised.

Central Provinces and Berar. (18.5 per cent). The area sown is reported to be 4,041,000 acres (2,786,000 acres being in Berar), showing a decrease of 4 per cent as compared with the corresponding estimate of last year. The yield is estimated at 825,000 bales (572,000 bales being in Berar) which is 11 per cent above the estimate reported at this date last year. The course of the monsoon was favourable to the crop in most areas and the rainfall was generally sufficient and well-distributed till the end of September. Weeding and intercultural operations were carried out without interruption and the growth of the plants was healthy, except in low-lying and water-logged areas in the Nagpur and Wardha districts. The clear weather during the greater part of October also favoured the growth of the crop, which developed satisfactorily everywhere. Heavy rain, however, fell towards the close of the month and again during the second and third weeks of November in all the important cotton growing districts. Since then, the weather has been clear and cool. The season promised an excellent harvest until the first picking was nearly completed. The unusually heavy rain at this stage was most unfortunate and adversely affected the newly formed bolls. The cloudy weather also helped the propagation of boll worm. On the other hand, it is anticipated that in some places the rains might encourage an extra crop of bolls. The average outturn for the province as a whole, is at present estimated at 79.8 per cent of the normal, as against 69 per cent reported at this date last year. It is, however, reported that this forecast is a conservative one, particularly for Berar, as it is not possible at present to estimate the possibilities of revival after the damage of rain.

Cotton in Foreign Countries.—From information specially obtained, it appears that the production of the 1936 cotton crop of the United States of America is estimated at 12, 407,000 bales of 500 lbs. each (equivalent to 15,509,000 bales of 400 lbs. each), as compared with 10,638,000 bales, the final estimate of 1935. The area and the first estimate of production of the cotton crop in Egypt for the current season are placed at 1,781,000 acres and 2,327,000 bales of 400 lbs. each, showing an increase of 3 and 10 per cent, respectively, as compared with 1935-36. From the latest available bulletin published by the International Institute of Agriculture, Rome, it appears that in Uganda, the area under cotton during the current season (sown up to the end of September 1936) was estimated at 1,412,000 acres, as against 1,140,000 acres at the corresponding time last year. The first estimates of area and yield of cotton in China for 1936-37

are placed at 8,357,000 acres and 5,457,000 bales of 400 lbs. each, as compared with 5,318,000 acres and 2,713,000 bales of 400 lbs. each in 1935-36.

RICE

Second Rice Forecast.

All India.—This forecast is based on reports furnished by the under mentioned provinces and states, which comprise 96 per cent of the total rice area in India. The forecast refers practically to the whole of the rice crop (early and late) in all the reporting provinces and states with the exception of the summer crop and the crop in Coorg and Mysore,

Second Forecast.

A—Area.

Provinces and States.	1936—37.	1935—36.	Increase (+) or Decrease (−)
	(1000 acres)	(1000 acres)	(1000 acres)
Bengal (a)	21,360	20,688	+672
Burma.	12,528	12,455	+ 73
Madras.	8,504	(b) 8,410	+ 94
Bihar (a)	9,927	9,343	+584
Central Provinces and Berar (including Indian States)	7,574	(b) 7,529	+ 45
United Provinces (including Rampur State) (a)	6,643	6,639	+ 4
Assam (a)	4,882	(b) 4,789	+ 93
Orissa (a)	5,826	(b) 6,257	−431
Bombay (including Indian States)	2,141	(b) 2,398	−257
Sind (including Khairpur State)	1,070	(b) 1,130	− 60
Hyderabad.	794	867	− 73
Baroda.	167	206	− 39
Bhopal (Central India)	30	25	+ 5
Total ...	81,446	(b) 80,736	+710

information regarding which will be included in the final general memorandum to be published in February 1937. The reports relate generally to conditions up to the beginning of December. The total area

reported is 81,446,000 acres, as against 80,736,000 acres (revised) at this time last year, or an increase of one per cent. Weather conditions have been generally favourable and the present condition of the crop is, on the whole, reported to be satisfactory. The following table shows the area and the estimated outturn as far as available. The table of outturn is incomplete, owing to the absence of estimates from Madras, the United Provinces, Hyderabad, Baroda and Bhopal which are not available at this stage; complete estimates for Orissa also have not been received.

B—Outturn of Cleaned Rice.

Provinces and States.	1936—37.	1935—36.	Increase (+) or Decrease (−)	Yield 1936—37	per acre 1935-36
	(1000 tons)		(1000 tons)	lbs.	lbs.
Bengal (a)	9,879	(1000 tons)	+2,493	1,036	800
Burma.	4,807	7,386	− 341	859	926
Madras.	(c)	5,148	...	...	...
Bihar (a)	3,351	(c)	+ 882	756	592
C. P. and Berar includ-		2,469			
ing Indian States.	2,334	(b) 1,867	+ 467	690	555
U. P. (including Rampur States) (a)	(c)	(c)	...	...	...
Assam (a)	1,665	(b) 1,530	+ 135	764	716
Orissa (a)	(c)	(c)	...	...	...
Bombay (including Indian States)	827	(b) 1,026	− 199	865	958
Sind (including Khairpur State)	479	(b) 387	+ 92	1,003	767
Hyderabad.	(c)	(c)	...	...	...
Baroda.	(c)	(c)	...	...	...
Bhopal (Central India)	(c)	(c)	...	...	...

(a) Includes autumn and winter rice, (b) Revised, (c) Not yet available.

Central Provinces and Berar.—(8.1 per cent) The area sown is estimated at 7,574,000 acres 1,950,000 acre being in Indian States), as compared with 7,529,000 acres (revised) last year. The yield is estimated at 2,334,000 tons 569,000 tons being in the Indian States), as against 1,867,000 tons (revised) last year. Seasonal conditions were, on the whole, favourable and the year was a good one for the crop. For the province as a whole, the average outturn is estimated at 106.9 per cent of the normal, as against 87.7 per cent last year,

Rice Crop in Foreign Countries—From information specially obtained, it appears that the official estimates of the second rice crop of Formosa for 1936 place the area and yield at 939,000 acres and 25,281,000 bushels (or 715,000 tons) respectively, showing a decrease of about one per cent in area an increase of 6 per cent in yield as compared with the same crop of 1935. The rice crop in Japan for 1936 is estimated at 67.84 million koku (or 9.9 million tons), which is 17 per cent above the actual crop last year. In Korea, the production of rice for 1936 is estimated at 19.95 million koku (or 2.8 million tons), which is 11 per cent above the actual crop of last year. The area planted with the 1936-37 crop in 60 provinces of Siam at the end of November 1936, was estimated at 18,048,000 rai (or 7,219,000 acres) approximately, as compared with 19,676,000 rai (or 7,870,000 acres) at the corresponding period of last year. From the latest available bulletin published by the International Institute of Agriculture, Rome, it appears that the estimates of 1936 crop of the United States of America are 895,000 acres and 906,000 tons respectively, showing an increase of 13 per cent in area and 18 per cent in yield as compared with the preceding year. In Italy, a good crop is anticipated in spite of damage caused by cold weather and stemrot.

College and Hostel News.

Janmashtami Festival.—This year the Janmashtami festival was celebrated on a grand scale with full co-operation of all the students. The essay writing and elocution competition were the new features of the programme.

Prcf. Telang Shastri delivered a lecture on " The Life and Teachings of Lord Krishna" for which the management expresses its heartfelt gratitude. Mr. Athawale and friends provided an excellent musical entertainment which was well attended by the members of the staff and the students. We offer our thanks to all those who helped us to make this function a success.

Ganesh Festival.—Great zeal and enthusiasm was shown by all the students in the celebration of the Ganesh festival. The Students night had its characteristic mirth and delight. Under the able direction and supervision of Prof. B. R. Phatak, B. Ag. (Bom) a Marathi drama " Lapandava " was staged by the students in the Victoria Technical

Institute Hall with a grand success. The proceeds of the show was donated to the Poor Boys Fund Society. The management thanks all the members of the staff and students for their co-operation in bringing the celebrations to a successful close.

Games and Sports.—The respective game secretaries showed keen interest in preparing their teams for the approaching University tournaments. The untiring efforts of our Principal Mr. E. A. H. Churchill assisted by Messrs B. S. Rao and M. A. Rahim in improving the condition of the play ground are worth mentioning. Their constant visit to the play ground was a source of great encouragement. We should not miss this opportunity to express our sincere thanks to them for the keen interest they have manifested in the College activities.

We are delighted to find Messrs Bhide and Sakalle among freshers as good sportsmen; special mention may be made of Messrs M. K. Deoskar, V. S. Kulkarni and K. G. Bhide (Cricket), Messrs P. M. Shrivastava, K. R. P. Nair and Y. R. Saoji (Football, and Messrs B. L. Choudhri, C. M. Kekre and S. N. Sakalle (Hockey) who displayed good show in the University tournments.

For the University tournaments our College had to play the first round with the Law College in Football, Hockey and Cricket. The defence given by our teams in football and hockey was admirable. The matches were interesting and well contested though finally we had to give way to the strong opponents.

The College was closed for Divali on 2nd November after the examinations were over and reopened on 21st November 1936.

U. T. C.—It is indeed a matter of great joy to record our College activities in the U. T. C. during ths year 1936-37.

The following promotions bring a great credit to our College and the members concerned deserve admiration.

1. Under Officer T. G. Deshpande
2. Corpl. I. S. Dube (Recruit Instructor)
3. L/ Corpl. W. B. Date
4. „ N. B. Gupta
5. „ M. D. Patil

We are really indebted to Mr. W. A. Bombawala for his able guidance and instruction which greatly accounts for the success in Guard Mounting Cup Competition. The members concerned in the Guard Mounting Cup Competition deserve congratulations upon their victory. We are sorry to notice that success could not crown our efforts in the Recruits Cup Competition in which we missed narrowly. We wish the best of luck in the coming year for the members of our Platoon.

The annual Social Gathering.—The annual social gathering of the College was celebrated on the 22nd of December 1936. It was because of some abnormal conditions that the celebrations had to be performed on only one day. The celebration started on the morning with tennis finals. This was attended by large number of students and staff members. The matches were very interesting and well contested. Mr. M. K. Deoskar won the Tennis Championship cup and Mr. K. R. P. Nair won the runners prize. We congratulate them for their success.

At 3 P. M. the address and the prize distribution ceremony commenced under the presidentship of Dr. Sir H. S Gour, Bar-at-law, D. Litt, LL. D., Vice-Chancellor Nagpur University. The function was attended by the students and the staff and some leading citizens of Nagpur interested in Agriculture and our College. The Principal opened the proceedings with a short speech in which he introduced the president to all. He also drew the attention of the Vice-Chancellor towards the weak relations of the College and the University and expressed that he would see the University coming in more close relations with our College.

The General Secretary then read a short account of the social activities during the year. He also dealt with the necessity for certain important improvements in the hostel and its surroundings. This was followed by the distribution of prizes and medals by the president.

The president then gave an interesting and instructive address on the practical application of agricultural knowledge and emphasised the importance of Agriculture in National Prosperity.

The president and the guests were then garlanded and all of them moved to the grounds of the Research Institute where Mr. and Mrs. Churchill were at home to the guests.

Thus the social gathering ended in a sweet programme. The students owe their deep gratitude to all who helped them in making the function a success.

The College Debating Society.—The 2nd meeting of the College debating society held on 15th August 1936 was an extra-ordinary one when we had the visitors debate and the following resolution was discussed.

" In the opinion of this house India's Salvation lies in the hands of the agriculturists and not in those of the professional politicians".

R. S. D. V. Bal, Messrs Mangalmurti, Vazalwar, Sontake, Gokhale and B. S. Rao participated in the debate and made it a success. we thank them all for the troubles they took.

In the 3rd and 4th meetings of the society the following resolutions were discussed.

" In the opinion of the house a Country man is better placed than a Town man"; and " In the opinion of the house the Agricultural College should be thrown open to qualified female candidates."

The students who participated really deserve congratulations for the progress they have made in the sphere of debate.

College News.—We are very glad to note that Mr. P. D. Nair, M. A., L. Ag. (Hons) the worthy Editor of our College Magazine and Professor in Economics has been appointed as Assistant Director of Agriculture. We wish him success in his future life.

We are very sorry to miss Dr. P. A. Shukla our professor in Veterinary Science who was well experienced and a good teacher. His affectionate attitude towards us reminds us of his days. We wish him a smooth and prosperous life in his old age.

We are glad to welcome Dr. Dighe who is a worthy successor to Dr. P. A. Shukla as our professor in Veterinary Science. We wish him too a grand success in his future life.

It is with great sorrow that we record here the tragic death of Mr. R. W. Ramteke (a first year student) due to a motor accident that took place near Ramtek.

The Nagpur Agricultural College Magazine

VOL. XI NO. 3 & 4

FEBRUARY & MAY 1937

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Contents.

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Editorial

We tender our apologies to our subscribers for not having been able to release under a separate cover the issue which was due in February. Reasons have been many and unavoidable, the foremost of them being that the editor of the Magazine who had to shoulder fresh responsibilities in the Departmental activities could not find sufficient time to look into details which are very necessary before an issue of a magazine is presented to the public. It has therefore been amalgamated with the present one.

* * *

Mr. P. D. Nair, M.A., L Ag., who was the editor of the Magazine has expressed that he can no longer associate himself in that capacity as in his new role of Deputy Director of Agriculture, Western Circle, with headquarters at Amraoti, he cannot have either the time or the facilities to discharge the onerous duties of the editor which he so very ably did during the last several years when he was associated with the teaching in the College. The Magazine has reached its present standard due to Mr. Nair's unflinching efforts. It is no easy matter to find readable stuff to fill the pages of a magazine devoted to

agriculture. It was Mr. Nair's wide reading and thorough grasp over various topics pertaining to agriculture in general and Agricultural Economics in particular that placed him under no embarrassment when, for want of sufficient response from the public in the shape of contributions for publications, the editor was pinched to write. One has only peep into the previous issues of the journal to be impressed by the variety of subject on which he wrote clearly, concisely, and elegantly. His handing over the destiny of the magazine into less experienced hands at this juncture is almost a calamity which cannot be averted. But we very confidently hope that the retiring editor will ungrudgingly place at the disposal of the magazine his talents to illumine and burnish. We wish to take this opportunity of placing on record our gratitude towards Mr. Nair for the very valuable services, rendered to this magazine by him and wish him good luck in his new office.

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Mr. E. A. H. Churchill, B. Sc., Principal of the College has gone home on eight months leave. Mr. J. F. Dastur M. Sc., D. I. C. Mycologist to Government, C. P., has been appointed to officiate as Principal. We heartly welcome him in that capacity. We are sure that he will follow the traditions of his worthy predecessors by associating himself with the acadamic and social life of the College, and leave very pleasant memories of his regime. We are also confident that Mrs. Dastur who is well known for her hospitality and interest in student's welfare will continue to extend the same, and shall follow the noble examples set up by Mrs. Allan, Mrs. Plymen, Mrs. McDougall, and Mrs. Churchill in their associations with the College.

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Our felicitations go to Rao Bahadur G. K. Kelkar and Rao Sahib D. R. Moharikar two well known officers of the C. P.

Agricultural Service on their being decorated with the above honours on the occasion of the coronation of their Majesties.

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The Department of Agriculture, C. P. is due to publish the results of its experiments during the Quinquiennium 1930 to 1935. With the advance in the technique of the lay out and conduct of experiments and the statistical interpretation of the results obtained, a highly qualified statistician who will be able to mathematically weigh the effects of the various factors contributing to the differences in the qualitative and quantitative observations made during the period of experimentation, is a great asset. We are happy that Dr. R. J. Kalamkar, B. Ag., B. Sc., Ph. D., has stepped into the C. P. Agricultural Service just at the right time to desentangle and draw useful inferences from the mass of figures which have been submitted by the experimental farms in the Province.

We welcome Dr. R. J. Kalamkar, one of our brilliant alumni who has been appointed as Assistant Director of Agriculture in C. P. After working on the Rothamstead Farm for two years and obtaining the degree of Ph. D. (London) Dr. Kalamkar on his return to India was appointed Assistant Agricultural Metereologist in the Government of India Weather Office, Poona. His contributions, dealing chiefly with statistical work correlating the effect of climatic variations on crop growth have been highly acknowledged. We are confident that he will be a great asset to this Province and wish him the best of luck.

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Central Provinces is well known for the area it has under, and the variety of oilseeds grown in it. Its area of 2.2 million acres under oilseeds constitutes 12% of the total area under oilseeds in India. Its area under linseed (935,000 acres) is larger

than in any other Province. With the industrial developments in India and the preference given to Indian Oilseeds in Britain, it has been found that there is considerable scope for improvement among the varieties of the oilseed crops grown in the Province. The Imperial Council of Agricultural Research, in India has kindly extended its patronage towards the oilseed scheme proposed by the C. P. Agricultural Department. We are glad that Dr. R. H. Richaria M. Sc., Ph. D., has been appointed as Oilseed Expert. Dr. Richaria is not a stranger to this Provinces. He had a brilliant career in the College of Science, Nagpur. After taking his M. Sc., degree of the Nagpur University, Dr. Richaria had the benefit of two years study in Cambridge where he specilized in Plant Genetics and was conferred the Ph. D. degree. His intimate knowledge of the agricultural conditions in C. P. will, we are sure, enable him to tackle the several problems, connected with oilseeds from proper angles of vision, to the best interest of the Province. We wish him complete success in his investigations.

Great importance is being given to the study of Agricultural Economics in the Agricultural College not only because the Nagpur University recognises the B. Ags. of this College as being equipped with sufficient knowledge of the principles of economics to study for the M. A. examination in Economics, but also due to the fact that the agricultural problems themselves have now to be examined from very far reaching economic points of view. In India those who are qualified to teach Agricultural Economics could be counted on one's figurs ends. Mr. P. D. Nair, M. A., L. Ag., was among these exceptional few. The College has sustained a great loss by the termination of Mr. Nair's associations with the teaching in the College. Mr. Nair's place has been filled up by Mr. N. M. Joglekar, M.A., LL. B., who has been for some time lecturer in Economics in the Hislop College. The selection has been a very happy one. His intimate knowledge of law will we are sure be a great supplement to the students of

Agricultural economics. We are sure that with his zeal and energy the subject which has been entrusted to him will be handled in as masterly a fashion as by his predecessor.

Doctors recommend that fruits should no longer be the luxury of the rich but should be included in the daily diet of the poor as well in order to improve the health of the people in India. There is the "Eat more fruit" campaign to give the necessary fillip to fruit growing. Apart from the necessity of a variety of fruits for the local population, with the transportation and cold storage facilicties which have been greatly improved, there are good prospects of the C. P. Agriculturists growing certain fruits like the orange, for which C. P. is already famous, for export and reaping good profit. Investigations pertaining to different problems connected with fruit culture have necessarily to be taken up before the C. P. fruits can enter the distant markets. The Agricultural Department, C. P. was badly in need of a specialist in Horticulture. We are glad to record that the post of a Horticultural Expert to be in charge of the C. P. Citrus Scheme for a period of five years has been sanctioned by the Imperial Council of Agricultural Research, India, and we are glad to welcome Miss. Rajul Raojee Bhai Shah, B. Ag., M. S. (Mich.) who has taken charge of the duties of the new post. Miss. R. Shah hails from Bombay. She is one of the pioneers among the women of India to study Agriculture the hardships of which are discouraging even to many of the stronger sex. After obtaining the B. Ag. degree from the Poona Agricultural College she proceeded to America where she specialised in fruit culture and obtained the M. S. degree of the Michigan University. After returning from America she was for sometime associated with fruit research in Bihar. We are sure that her example will be followed by the some of the ladies in this Province to take to agricultural research. Women are as well fitted as men for research work. Contributions to research in agriculture by the late Mrs. Howard and Dr. Miss Janakiammal, now at the

Coimbatore Sugar Research Station, bear ample testimony for their fitness.

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We are glad to welcome Messrs B. Raja Rao, M. Sc., and S. S. Chiney, B. Sc., who have been appointed in the Entomological and Chemical Sections respectively.

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Rai Sahib G. R. Dutt, Entomologist to Government, C. P., had to undergo an operation in the ear for "Mastoids." We are glad to note that after a successful operation he is making speedy recovery.

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Our hearty congratulations to our past students Messrs Y. K. Dhabadkar and G. W. Pitale for having come out successful in the final law examination of the Nagpur University, and Mr. P. M. Ganorkar for having passed the previous law examination of the Nagpur University. Mr. Y. K. Dabadkar has been placed in the first division. We are proud to mention that all the B. Ags. who have in the past attempted for Law have been successful and some of them have passed very creditably too.

Mr. M. A. Kolkhede, student of the senior B. Ag., class deserves our hearty congratutions on having won the prize which was instituted by J. H. Ritchie Esquire., M.A., B. Sc., Director of Agriculture, U. P. for an Essay on "Importance of fruit as diet and as a crop." His article has been published in this issue and we are sure that his success will inspire other students for similar attempts.

That the income to the cultivators from the crops grown, is insufficient even to satisfy their barest wants is very patent. For reasons which are obvious the Indian cultivators cling to their

land even if it should mean semi starvation to them. The Agricultural Departments in the Provinces no doubt have been very helpful in putting into their hands improved varieties of crops and suggesting, methods of cultivation and manuring which also enhance the harvests. But, unfortunately for the cultivators, in recent years increased production of crops like Wheat, Paddy, Cotton or Sugar has not meant incresed profit in terms of money on occount of fall in prices. Very often even harvests are below expectations due to climatic conditions which cannot be controlled by any means. Hence it is very necessary to suggest to the cultivators some industries in which they can engage themselves in order to supplement their income directly from land. Poultry Keeping and Bee Keeping are two vocations which could be taken up by the villagers. Attempts are being made in Madras Mysore and Travancore to popularise Bee Keeping. Special assistants who are trained in Apiculture (Bee Keeping) are sent to villages to teach the villagers the details in connection with the art. We are sure that the article on Bee Keeping from the Director of Agriculture, Madras, reprinted from the Hindu will be very useful for those who are interested in this industry which has since recently been engaging the attention of people interested in Village Uplift. We will be grateful if experience of those who have tried their hands at Bee Keeping will be sent to us for being pubished in the pages of this Magazine.

Poultry farming is another industry which, without any big capital investment, has been found to be remunerative provided proper attention is paid to details regarding sanitation, feeding, etc., of the birds. We learn that there are some persons in this Province who have been keeping poultry on a business scale. We request them to let the public have the benefit of their experience through this Magazine.

Original Articles

"IMPORTANCE OF FRUIT AS DIET AND AS A CROP".*

BY M. A. KOLKHEDE (SENIOR B. AG.)

To get a clear idea of the subject, it is better to divide the subject into two parts.

(1) Importance of Fruit as Diet.

(2) Importance of Fruit as a Crop.

Introduction.—Diet is the basis of good health. It is therefore absolutely necessary that we should have the best diet. On our diet depend our physical and mental powers. Our present diet is not an ideal one because all vitamins and other important ingredients (*i. e.* minerals) which are essential for the development of our body are removed from it. Most medical men agree that fruits of various kinds should be included in our diet to make it an ideal one. Lack of minerals and vitamins in our present diet is the cause of various diseases. Different kinds of fruits are the important source of vitamins and minerals. Fruit is a natural tonic 'Prevention is better than cure'; many diseases are due to our defective diet, therefore we must include plenty of fresh fruits in our diet which will protect us from diseases. In India many people suffer from constipation and indigestion due to their defective diet. To remove constipation and to prevent indigestion fruit diet is the best remedy. In short, it may be said that fruit diet is the only important source of radiant health.

Present Indian Diet.—In India, diet from Province to Province, varies according to local agricultural conditions, still an average diet of an Indian family consists of *polished* rice, bread made out of *sifted* wheat or juari flour, various pulses with their *husk removed*, flesh, various oil preparations, spices and condiments. Polished rice, sifted wheat or juari flour and pulses without husk are completely deprived of their vitamins and mineral contents, on account of these unnatural treatments. Fashionable and civilized people consider it indecent to eat unpolished rice, bread made out of whole wheat or juari and pulses with husk. All these food stuffs, or artificial preparations made out of them, are very difficult to digest and therefore cause various diseases like indigestion and constipation. Hence to fill up the deficiency of vitamins and minerals, our present diet should be supplemented with plenty of fresh fruits.

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* This essay won the prize which was instituted by the Director of Agriculture United Provinces, for an essay on "Importance of fruit as diet and as a crop."

Ideal diet.—An ideal diet is one which consists of plenty of vitamins and minerals and keeps our body in a healthy condition. It should contain minerals like calcium, potassium, phosphorus, and iron which are quite essential for the healthy growth of our body. It must contain all the vitamins in large proportion and should be easily digestible. Many doctors say that the average life of Indians is very short because they take more of acid food. Therefore healthy diet should consist of 80 per cent alkaline and 20 per cent acid food. The important acid foods and drinks are meat, wheat, bread, nuts, peas, beans, pulses without husk, white sugar, tea, coffee etc. But it is most interesting to note that all fruits are alkaline in nature. Hence to make our diet 80 per cent alkaline, major part of it should consist of fruits.

Under the present Indian conditions the following will be an ideal diet, suitable for any middle class family. Break-fast should consist of milk, apples, raisins or any other fresh fruits that are available. Then meal at 11 a. m. consisting of bread, rice and plenty of fresh green vegetables. At 3 p. m. some fresh fruits like oranges, papaya, apples, guava, banana grapes and again milk, nuts, and oranges at 8 p. m. Besides this when ever one is hungry, he should take fruits, that are available. Fruits are far superior to any preparation in a Baniya's shop. The above mentioned diet is especially suited for young boys who require plenty of vitamins and minerals for their rapid growth.

ADVANTAGES FROM FRUIT DIET

(A) **Sound health.**—Everybody knows that "Health is wealth," but very few people know, how to get this wealth. Cheapest and the simplest key to get this wealth is to take as much fruits as possible in daily diet. Fruits are very easy to digest and therefore do not cause any disease. Many fruits like mangoes, banana, apples and grapes serve as tonic and keep the whole system in a sound condition. Liberal supply of vitamins and minerals is necessary for sound health and is only given by fruits. Americans have given much share to fruits in their diet and the result is that they are more healthy and live longer than Indians.

(B) **Prevention of diseases.**—This is the most important advantage which fruit diet has over the ordinary cereal and pulse diet. As fruits are very rich in vitamins and minerals, there is no fear of suffering from the diseases arising from the lack of vitamins and minerals. Fruits are very easily digestible and thus they prevent us from indigestion which is

the root of many serious diseases. Many fruits contain citric, malic and tartaric acid. These acids are converted into carbonates in the body and help to render the fluids of the body more alkaline thus keeping the body in perfect health. Many fruits like oranges and lemons bave laxative action on the bowels; therefore when such fruits are taken daily, people do not suffer from constipation which is the most common disease amongst Indians on account of their defective diet.

(C) **It cures many diseases.**—The best remedy for constipation is, 3 days fast and 10 days complete fruit diet. Teeth diseases are cured by eating plenty of oranges and figs which supply calcium and vitamin "C." To drive away uric acid from the system, figs which contain sodium are very useful. Deficiency of iron in blood is recouped by eating raisins. Fruits like banana help to purify impure blood. Citric, malic and tartaric acid which fruits contain are useful in medicine. These acids also kill jerms of many diseases. In typhoid fever grape juice is very useful. The pure medicines produced in the human laboratory by eating fruits, are the only real medicines. Plantains cure eye-diseases. During Malaria and seasonal fevers, "Anar" (pomegranate) is recommended as a cooling beverage to ameliorate the action of the bile. Syrup of "Anar is commonly used as febrifuge.

Diet specialists like Josiah Oldfield of England and Macfadden in America have proved that by the fruit diet, most obstinate cases of disease will be cured. In this connection the following case is of much interest. One gentleman named Bate was 50 years of age. Doctors despaired of his life, but Mr. Bate decided to try to save himself by dieting. He fasted for 46 days and was reduced to 88 lbs. in weight and afterwards lived only on fresh fruits, avoiding meat and cooked foods. Afterwards he became very strong and could lift 50 lbs weight. He died after 22 years *i. e.* at the age of 72 years in a motor accident. For these 22 years he completely lived on fruit diet and enjoyed sound health.

(D) **Supply of minerals.**—All kinds of mineral salts, the body requires, can be obtained in the best forms from the fruits, as for example—(1) Phosphorus is obtained from apples. (2) Calcium which is very important for the formation of bones and teeth, is found in oranges and figs. (3) Potassium which is necessary for muscular is found in raisins (*i. e.* dried grapes) (4) Sodium which helps to get rid of the uric acid from the

system, is found in figs (5) Iron which is the important constituent of blood and on which redness of blood depends, can be obtained from raisins. Mineral contents of some of the important fruits and foods are given below, to show the mineral value of fruits.

Rice ...	... 0.76 per cent.	Plantains ...	... 0.73 per cent.
Boiled rice	... 0.30 ,,	Raisins ...	... 3.40 ,,
Wheat ...	... 1.60 ,,	Oranges ...	... 0.70 ,,
Wheat chapatie or puri ...	... 0.53 ,,	Grapes ...	... 0.53 ,,
Meat (goat)	... 1.20 ,,	Mangoes (ripened)	...10.2 ,,

The above figures show that mangoes are very rich in minerals; therefore mangoes taken regularly in large quantities serve as tonic. The most important thing in case of minerals, contained in fruits, is that, they are more easily assimilated by the system than the minerals in other food.

(E) **Supply of vitamins.**—Fruits are the important source of vitamins. Citrus fruits, especially oranges and lemons are very rich in vitamin 'C'. When there is deficiency of vitamin 'C', the complexion becomes sallow, the skin is easily injured, the gums become spongy and bleed easily, thus causing the teeth to become loose and brittle. Vitamin 'B' aids digestion, nerves, and growth and is found largely in papaya, plantains and apples. The following chart shows the vitamins contained in different food stuffs and fruits.

+ = Fair amount; ++ = Large amount; + + + = Abundant; .. = Little; 0 = not; 4 = Satisfactory; 2 = Less; 1 = Too less.

Vitamins		*A*	*B*	*C*	*D*
Unpolished rice	...	+	+		
Polished rice	...	0	0	0	
Chapati or puri	...	–	+	–	+
Cake	...	0	0	0	0
Refined sugar	...		0	0	0
Mango	...		+	+	
Plantain	...	+	+	+	
Papaya	...	+	++		
Lime juice	...	–	++	+++	
Grape juice	...		++	++	

Apple	...	+	++	
Juar	...	2	4	1
Oat	...	2	4	1

The above table shows that fruits contain much more vitamins than any other food stuffs like rice, chapatis and cakes. Therefore if we want to be healthy and live longer, we must take plenty of fruits in our daily diet and gradually reduce the quantity of these bulky substances.

(F) **Life is lengthened.**—Various preparations made out of wheat, rice and pulses, are very difficult to digest. These preparations cause much wear and tear of our intestines. Generally we do not chew our food properly, and as there are no teeth in the intestines, they require more strength to digest this crude food. But with fruits the case is quite different, they are very easily digested and cause much less wear and tear of the intestines, thus enabling them to function for a long time.

Analysis of some important fruits. Fuel value is given in calories per pound and the other constituents in per cent.

Name of the fruit.	Fuel value.	Water.	Protein.	Fat.	Ash.	Carbohydrates.
1. Orange ...	233	87.7	1.0	0.2	0.7	11.6
2. Straw-berry ...	175	90.4	0.8	0 6	0.6	7.4
3. Apple ...	285	84.6	0.4	0.5	0.3	14.2
4. Grapes ...	435	77.4	1.3	1.6	0.5	19.2
5. Banana ...	445	75.3	1.3	0.6	0.8	22.0
6. Dried Fig ...	1435	18.8	4.3	0.3	2.4	74.2
7. Raisins ...	1560	14.6	2.6	3.3	3.4	76.1

HEALTH VALUE OF SOME IMPORTANT FRUITS AND THEIR USES

(1) **Mango.**—It is called the "King of fruits," on account of its special qualities. It is very rich in vitamins and minerals. Some varieties like Alphanso and Pairi are very delicious and are highly valued

in foreign countries. Various sweets from Mango-pulp are prepared and are preserved for a long time. It serves as one of the best natural tonics. Various condiments and pickles are made from raw fruit and are very much relished by the people.

(2) **Papaya.**—It serves as a very useful tonic for building our body. Pepsin is extracted from raw fruit and is used as a valuable medicine in many stomach diseases. It contains vitamin B. and C. The fruits cure disease like enlargement of the spleen. As raw, it is used for vegetables condiments and pickles.

(3) **Apples.**—They contain vitamin 'C' and cure minor ills which arise from clogged digestive organs.

(4) **Oranges.**—They are good remedy for poor blood and poor complexions. They are the important source of vitamin B. and C.

(5) **Grapes.**—They are rich in sugar and are most nutritious. Their juice is used in many tonics and medicines. They are also rich in vitamin B. and C.

(6) **Figs.**—They are very rich in sugar which is easily digested. They are taken as food, as well as, a cleanser of system.

(7) **Dates.**—They contain large amount of sugar and are very useful for those who are very fond of eating much refined sugar which is harmful. In many parts of India they are specially eaten on a fast day.

(8) **Plantains.**—They contain much of carbohydrate in easily assimilable form. They serve as tonic and cure many eye diseases. Raw plantains, are used for vegetable.

(9) **Guava.**—It is a delicious fruit and is very much relished by people. It is essentially used for making jelly.

(10) **Pomegranate (Anar).**—During Malaria and seasonal fever, Anar syrup is commonly used as febrifuge.

In the end, it may be said that fruit diet is the only remedy for Indians to improve their health. Introduction of fruits in daily diet will make our food more delicious and nutritious. For the present even the educated class of people do not take fruits in their diet. The subject like "Fruit diet" is most important; therefore serious attention must be given

to it. Several books can be written on this subject. Some educated people have now realised the importance of fruit diet but the difficulty is that fresh fruits are not available on a large scale. This difficulty will be soon removed when fruits will be grown on a large sacle all over India.

Introduction.—Fruit growing is an important source of wealth in several countries in the world. It is regarded as a money crop, irrespective of, whether the fruit is sold fresh or is converted into other valuable products. It provides both work and cash even under adverse economic circumstances and thus enables the farmer to meet liabilities which would other-wise weigh heavily on his holding. It is not surprising therefore that a tendency to encourage fruit cultivation has been apparent in all countries during the past years. The mention of the monopolies in the fruit trade will give some idea of the importance and magnitude of fruit growing in other countries.

(1) **Italy.**—For example specialises in the cultivation of citrus fruits and wine grapes. Her annual export of citrus fruits comes to about 301,000 tons. The total annual wine production of *France* amounts to 1,232 to 1,254 million Imperial gallons. *Turkish* fruit growers annually export 57,000 tons of figs.

(2) **U. S. A.**—With their scientific ability, perseverance and organisation play a leading role in this field. Their annual export amounts to 238 million pounds of canned products ; 13 million boxes of fresh fruit and 365 million pounds of dried fruits.

(3) **Spain.**—Exports oranges and grapes to the extent of 931,100 tons out of which 300,100 tons are exported to the United Kingdom alone. The annual import of fruit into the United Kingdom however amounts to £ 48,000,000 which is equal to 64 crores of rupees, exclusive of foreign import which comes to 70 per cent.

In almost all countries fruit growing is a principal source of income to the agriculturist. In India the development of the fruit industry forms but a minor part of our agricultural activities because despite a vast range of soil and climatic conditions, fruit cultivation is not commercialized. In India, there are natural facilities for fruit growing and a growing demand for fresh fruits among the people. But fruit has not yet played any part in the export of agricultural commodities on which it is believed, India's economic prosperity depends so largely.

Common crops grown in India.—Paddy, cotton, wheat, pulses, jute and oilseeds are the crops which are commonly grown in India; out of these cotton is the only important money crop but nowadays it is also not paying on account of its low prices. The problem of cultivation is so serious that cultivators do not even get the cost of cultivation.

Recent inquiry made by the 'Cost of cultivation Inquiry scheme' shows that out of 70 cultivators in Berar only one was able to get back the cost of cultivation. While it is found that all fruit growers are quite happy.

Present condition of Agriculture in India.—On account of the repeated crop failure, all Indian cultivators are in distress. They are unable to pay land revenue. There are some villages in Central Province and Berar, the cultivators of which have not paid the land revenue of five continuous years. All Provincial and Imperial Governments are trying to improve this state of affairs but without sufficient money nothing can be done. Every body knows that 'Agriculture is the heart of India' but nobody cares for it. Such an important department like 'Agriculture Department' has not got sufficient funds at its disposal to carry on important schemes in connection with improvement of crops etc.

Land revenue is the chief source of income to the Government, still it spends much less on Agricultural Departments. If therefore Government wants that Indian Agriculture should be improved; it must grant at least 10 times the amount that they are granting now. Though the Directors of Agriculture have good schemes in their mind, they cannot bring these schemes into practice due to lack of money. Another noteworthy feature of Indian Agriculture is the 'Lack of Agricultural education.' There is no Agricultural education in A. V. Schools and High Schools. Agricultural education on practical lines is the urgent necessity of India. In U. S. A. alone there are 600 Universities, each of which has an Agricultural College while in India there are only 6 Agricultural Colleges having 1,040 students. The subject 'Importance of Agricultural education in India' is an exhaustive one and must be dealt separately some where also.

But we are very fortunate to have such an enthusiastic Viceroy at such a critical moment. H. E. the Viceroy is thoroughly acquainted with the Indian Agriculture and takes much interest in it. H. E. has first undertaken the problem of 'Cattle improvement' which is the backbone of

of India and after this we have strong hopes that H. E. will devote his mind to the 'Importance of fruit cultivation' in India.

Import of fruits in India.—In 1933-34, 15 lakhs worth of fresh fruit; 19 lakhs worth of almonds; currant and raisins; 36 lakhs worth of dates; 10 lakhs worth of canned and bottled fruit and other fruits worth 14 lakhs thus the total import amounted to 94 lakhs.

The following figures shows the import of citrus fruits from California and Italy.

Name of the Port.	*Amount in Rupees.*
Bombay	80,000
Calcutta	30,000
Total of all ports in India	130,330

In Bombay alone 50,000 lbs of lemon juice valued at one lakh of rupees is imported. By growing fruits on a large scale we can save the money which is going out of our country.

Scope for Indian fruits in other countries.—Gas and cold storage have helped fruit industry very much. Empire fruits by virtue of the Ottawa agreement, are admitted into the United Kingdom free of duty while foreign fruits pay duty under the Import Duties Act, 1932. On account of this facility, there is great scope for Indian fruit to conquer markets in the United Kingdom. United Kingdom alone imports fruits worth 64 crores of rupees every year; therefore even if India sends her fruits to United Kingdom alone, she can have the largest share of those 64 crores of rupees. Experiments have shown that most delicious varieties of mangoes like Alphanso can last for 9 weeks at 45° F temperature. Same is the case with oranges also. Some mangoes and oranges were exported to England and France. These fruits were much relished by those people. In this way there is great scope for Indian mangoes and oranges in foreign countries but the difficulty is that poor ignorant cultivators do not know all these scientific ways of cold storage and gas storage. For this purpose various 'Boards and Associations' in different localities should be started on scientific line like 'Fruit Development Board' in U. P. and Orange Growers Association' in C. P. which are doing good work.

Facilities given to fruit growers.—Nowadays agricultural departments in all the provinces are taking much interest in fruit cultivation. Agricultural Departments try to help the cultivators in all directions. Various legislative and adminstrative measures are being taken, with a view to protect the industry from unfavourable factors. Such measures tend. (1) to safe-guard the industrial and economic interests of the people from foreign competition, (2) to check the introduction of harmful pests and diseases along with new varieties of fruits or in other ways and, (3) to maintain economic balance between the growers expenses and risks and his profits. It is satisfactory to note that material advances have been made recently in the organization of fruit growers associations in the United Provinces, the Bombay Presidency and the Punjab. The reduction of railway freight declared by the G. I. P. and B. B. and C. I. Railway companies on perishable products is another helpful step. The United Provinces Fruit Development Board and orange growers association in C. P. are doing great deal of work in helping their members for planning their gardens, improving them and instructing them, how to look after them.

Various researches in fruit preservation.—Experiments are being conducted on the College farm to preserve plaintains by desiccation. Oranges for shipment are prepared by giving them antiseptic washes which destroy organism causing decay. The increasing importance of fruit diet, led to the research for cold storage of fruits. With this object Cold Storage Research Scheme for fruit, was started at Poona. The research has proved that at 45° F. mangoes can remain for 9 weeks. Most valuable digesting ferment known as 'papain' or vegetable pepsin can be easily manufactured from the milky juice of papaya. The pepsin is sold at Rs. 8 to 10 per pound.

Advantages from fruit cultivation.—There are many advantages from fruit cultivation but only the important ones are given below. Fruit cultivation gives more profit than any other crop. To have some idea of profit from some of the important fruit trees, their description is given.

Mangoes.—With distance 30 x 30 feet we can plant 48 trees in one acre. Taking 200 fruits per tree, we get 9,600 fruits per acre. These trees are supposed to be of good and delicious varieties like Alphanso and Pairi which are sold at the rate of rupee one per dozen, thus from an acre we will get at least Rs. 800/- The cost of cultivation nearly comes to Rs. 200/-, leaving a net profit of Rs. 600/- per acre.

Oranges.—Supposing 100 plants per acre, yielding on an average 400 fruits per tree will give us 40,000 fruits per acre. The minimum rate of oranges is rupee one per hundred thus giving Rs. 400/- per acre cost of cultivation generally comes to Rs. 200/-. Even if the cultivators sell their garden on contract, they will get at least Rs. 100/- per acre.

Banana.— Taking 400 plants per care and 100 fruits per tree we get 40,000 fruits per acre. These sold at the rate of rupee one per hundred, we get Rs. 400/-

On the whole we see that any fruit tree gives at least Rs. 200/- per acre as net profit. While from any other crop we do not get more than Rs. 10/- per acre. For growing other crops we are to exert much, still in the end we get only negligible profit. Seeing the above figures of profit anybody will question us that if this is the case why fruit cultivation is not undertaken by many farmers? The answer to this question is very simple. Cultivators do not grow fruit trees because in the beginning fruit cultivation requires more capital and risk. Another important difficulty in the way is that we are to spend much money in the beginning without any profit. We are to wait for longer time to get much profit.

Second important advantage is the '*Assurance of crop*'. In the years when our cotton, wheat and paddy crops fail on account of adverse climatic conditions, garden, trees generally do not fail to yield fruits. This is the reason why cultivators having some sort of fruit garden are happier than the cultivators who are merely dependent on seasonal crops.

Third advantage is '*Less exertion*' In case of garden crops a cultivator has merely to supervise his garden with little work here and there. But in case of seasonal crops, every year he has to prepare his land and do various operations like sowing, interculture, weeding etc., even with all these troubles he is not sure of his crop. While in case of garden trees he can get much more profit with less exertion for a number of years.

Fourth advantage is that the garden plants are much less affected by diseases and pests than seasonal crops. If at all garden plants are affected by some disease or pest, one can very easily treat them on account

of limited are while in case of seasonal crops it is very difficult to control such vast area.

Fifth advantage from fruit cultivation is that it is one of the important sources of increasing national wealth. We already know that United Kingdom alone imports fruits worth 64 crores of rupees; it is possible for us to supply at least half of the demand. Moreover Empire grown products are not charged any import duty and are given preference. Therefore even if we supply half of the United Kingdom's demand, our income will increase by 32 crores of rupees.

Sixth advantage is that a cultivator and his family can enjoy sound health. A cultivator should grow variety of fruits in his garden and should take much of the fruit in his diet; he and his family will enjoy health, reducing much of doctor's bill.

Employment of educated youths.—The problem of unemployment is very serious in India. Many great men are trying to solve this problem. Thousands of graduates are wandering here and there. Many people advise these unemployed graduates to go to land but the difficulty is there is not so much of capital and land. Second practical difficulty is that these graduates will not be able to maintain themselves by growing seasonal crops, as even the skilled cultivators have failed to do so. Therefore the best solution for this problem is to advise these graduates to undertake fruit cultivation. On an average 40 per cent of them can afford to buy land and spend some initial capital. A graduate should know that he has spent at least Rs. 2,000/- to Rs. 3000/- on his education and now it is his duty to spend Rs. 1,000/- more for laying out the foundation of his happy life.

Many of the unemployed youths are the sons of Government servants who have some money in banks. Many times these graduates put forth the excuse that they have no capital but this not the fact in all cases. This is simply an excuse forwarded to hide their lack of spirit. The real thing is that many of these young men do not want to take risk, though there are very favourable chances for them in future. In their school and college life they are nicely brought up and afterwards also they want to get a job and any how pass their life. They are ready to accept a job of Rs. 20/- to 30/-. The graduates who have spent Rs. 30/- to 40/- per month in their college life cannot be expected to live within Rs. 30/- with their family but any how they are forced to pass their life

miserably. Day by day there is no hope of getting a job of Rs. 30/- even and the condition is growing still worse.

These educated youths should wander in this world with open eyes and should study the whole situation with their educated mind. If we advise them like this, they say that "It is easy to talk but very difficult to follow." But they should bear in mind that if their ancestors would have also thought like that, then the world would have been still in the savage state. They have studied the lives of various scientists, inventors and adventurers like Sir Thomas Edison, Sir James Watt and Columbus. They know that there can be no progress in the world if men taking risk do not come forward. I am sure that there is not as much risk in fruit cultivation as in other business. Only thing required in fruit cultivation is "Patience;" one must wait for some time to get the sweet fruits of his labour. Therefore now educated men should come forward with their scientific knowledge, to take to cultivation of fruits. After a short time they will reap the sweet fruits of their labour and much profit.

I am quite sure that educated men will live a far happier life than a man serving on Rs. 100/- even. They will be perfectly independent and live much more healthier life in the fresh air of rural areas. Another important thing is that these educated men will be the pillars of rural improvement. Government will also be much helped by these educated men. Fruit cultivation also affords very good opportunity to men who have retired from their service. They are the suitable men for undertaking this job. They have got ripe experience of the world and sufficient capital.

In the end it can be safely said that "Fruit cultivation" is much profitable. Increasing import of fruits in India shows that there is surely a growing demand for fruits. Fruits have not played any part in the export of Agricultural commodities on which it is believed, India's economic prosperity depends so largely. India possesses natural facilities for fruit growing. Climate and soil conditions vary largely, thus giving opportunity of growing different fruits in different localities. Much of the future Agricultural prosperity of India depends on fruit culture. It will be more prosperous, if educated men will undertake it. They will organise easily thus creating better marketing facilities. They will carry on any improvement quicker than other ignorant cultivators and make themselves and finally their mother India happy.

THE U P. INDUSTRIAL AND AGRICULTURAL EXHIBITION

By Dhanna Lal, L. Ag.

The Industrial and commercial advancement of the world, which has culminated in the process of "Mass Production", has also vastly changed the ways of salesmanship and contact between the producer and consumer. In the past it was the consumer who set the pace of production and the producer was only concerned with executing orders and producing things to the liking of the consumer. But now a days it is generally the producer who takes the initiative and produces new things to satisfy new demands, and therefore he has to take steps to acquaint the customer with his products, to show him their uses and thus to induce the prospective customer to buy his products. Besides this, with the increasing utilization of scientific knowledge in the production of goods, production is daily increasing by leaps and bounds, and therefore competition is becoming all the more keen. This fact has forced every producer to take resort to various methods of advertisement in order to push his goods into the market. One of them is the exhibition, and with the passage of time, it is more and more coming into fashion.

India was late in joining the race of industrialization but now that it can also lay a claim to be called an industrial country, exhibitions have come to occupy an important place in her industrial life. Moreover, besides being a means of advertisement of goods, the exhibitions also serve the purpose of educating the public, they are supported by the Government of every country, and also by other private and public bodies and by industrialists and businessmen. The Government looks to the exhibition as a source of educating the public, the industrialist depends upon it for the advertisement of his goods, the business man relies on it for broadening the market, and the consumer for information about cheaper and better goods to satisfy his wants. These exhibitions are useful to every important section of the public and therefore it is no wonder that they are encouraged by the government of every country. It gives us much pleasure to note that the government of India and its Provincial governments are not slow in recognising their utility and giving all possible support to them. The present U. P. Industrial and Agricultural Exhibition is an example of this, and though the initiative was taken by the U. P. Government, the Governments of other Provinces, specially of Bengal, Bihar, Bombay, the C. P. and the Punjab and States like Hyderabad, Mysore, Travancore, Indore, etc. whole-heartedly co-operated

with the U. P. Government, and it can be stated without any fear of contradiction that the credit for making the Exhibition a great success equally belongs to them all.

It will not be out of place to mention briefly the origin and history of the Exhibition. It was about a year back that Dr. Sir Jwalaprasad Shrivastava, Minister for Education and Industry of the U. P. Government conceived the idea of holding an exhibition of this province. He held consultations with other members of the Provincial Government and also with the prominent businessmen of the Province, and being assured not only of their passive sympathy but of their active co-operation, he chalked out the full plan of the Exhibition, got it approved by the Provincial Government, and at once arranged for setting up the machinery for carrying out the plan into execution. The task of constructing the buildings was entrusted to A. L. Carnegie the chairman of the Exhibition and under his supervision and guidance, within a short space of six months a vast park of 66 acres was converted into what are at present called the "Exhibition Grounds" with its pavilions, pylons, and stalls. The layout of the Exhibition is simply grand, and its beauty has all the more increased on account of its being flanked on all sides by the historical immambaras and other beautiful monuments built more than a century and a half ago by the then rulers of Oudh. A sum of Rs. 2½ lacs has been spent over the construction work of the Exhibition, part of which is substantial masonary work. Various domes have been lighted up in colours with the latest type of high pressure gaseous discharge lamps. The historical Rumi Darwaza has been decorated with ten thousand coloured bulbs, and a hundred feet high electric tower dominates over the whole Exhibition.

The Exhibition was formally opened on Saturday the 5th December 1936 by Sir Harry Haig, the Governor of the U. P., at 4-15 p. m., before a large and distinguished gathering. The proceedings started by a short speech by His Excellency who remarked that the Exhibition is a great lesson in facts. It is also a mental stimulant. It gives unrivalled publicity. Publicity is one of the essential factors in the development of Industry and Trade. Another feature of special value is the demonstration in the agricultural section which will show to the agriculturist how he can improve his practice and increase his income and thus to increase his buying capacity without which trade and industry in India cannot prosper." In these few sentences His Excellency very

aptly enumerated the various advantages derived by different sections of the public.

The Exhibition Authorities were also fortunate to successfully prevail upon His Excellency the Viceroy to pay a visit to the Exhibition, which he did on the 15th December 1936. His Excellency was much pleased with what he saw at the Exhibition. He inspected various sections, but was most interested in the exhibits and demonstrations of the agricultural section.

Having finished with these preliminary remarks, now I will deal with the Exhibition itself. As the name itself connotes, the Exhibition covers both the Industrial and Agricultural aspects of the eonomic life of the United Provinces in particular and of India in general. Care has been taken to display goods of Swadeshi origin—only such foreign goods have been displayed as are not manufactured in this country. Both these sections provide for (1) Advertisement of goods, (2) Demonstration of various methods of production; (3) Display of various goods; (4) Imparting of the knowledge of new inventions and scientific methods of production of both agricultural and industrial goods.

I will first briefly survey the Industrial Section and then deal in greater detail with the Agricultural Section—that being of more use and importance to a student of Agriculture. The Industrial section can be further sub-divided into three sub-sections, viz. (i) Big Industries; (ii) Cottage Industries (iii) Handicrafts and Arts. In this section the pride of place is held by the Textiles. Practically every important Mill of India has sent its products for display in the Exhibition and the visitor by simply looking at the beautifully arranged stalls get an idea of the progress made by the textile industry of India within the last few years. The Iron and Steel Industry is represented by big firms like the Tata Iron Works, the Martin Co.; the Indian Iron and Steel Co. etc., which put before the visitor goods made from Indian iron and steel, such as Dynamoes, other electrical appliances, Machines, and such household goods as fans, refrigerators, batteries, torches etc, which are of perfect workmanship and seem to be as good as any of the imported ones. The Government Mechanical schools of different Provinces have sent tools, accessories and mechanical appliances prepared by them The exhibits reveal to the visitor the fact that in this particular branch India is fast approaching the stage at which it will be able to satisfy all its needs.

Coming to the Cottage Industries and Handicrafts we find that this branch of industry is also well represented. The textiles occupy the first place in this section also. We see exhibits of the Cotton, Woollen and silk textiles coming from such distant places as Travancore, Kashmir, Assam etc. The demonstration side is the most perfect and complete in this section. The Bengal Government has arranged a complete demonstration of the silk cottage industry, in its pavilion, where the visitor sees the rearing of the silk-worms, and the various processes by which the silk thread is woven into fine fabrics. In the Cotton Textile Section we see improved varieties of handlooms which help the weavers to do their work easily and quickly. The Central Provinces are also represented and their weavers attract a good deal of attention. The dyeing and printing processes are also performed before the public. The Dari and carpet making industry demonstrates that though the Indian carpet weavers have lost much of their art, still they can produce goods to satisfy the taste of the most fastidious of their customers. The Glass industry is represented by bangle makers of cawnpore who make beautiful bangles. Other glass-wares such as flowerpots, dishes, chimneys, vases, glasses, etc., are also manufactured in India, and it is certainly unfortunate that due to the lack of marketing facilities the public is ignorant of these products. Then we come to the cottage leather industry, which occupies a pavilion of its own, where the process of tanning leather are shown to the visitor and the products such as shoes, handbags, money-bags, leather belts etc. are also displayed. Here, one finds that India has successfully produced such high quality of leather as chrome and chamois leathers. We also have demonstrations of the processes of Umbrella, making, brush making, metal polishing, lace making, embroidering, wood carving, the manufacture of toys and other things from clay, marble, ivory, wood and backalite. In short, the various Cottage Industries bewilder the visitor by their number and the ingenuity and the skill of the Indian artisans.

Several States such as Hyderabad, Mysore, Indore, Rewa, Gwalior, Baroda, Travancore, Rampur and Kashmir have sent exhibits of goods manufactured, within their borders. The British Provinces have not lagged behind. The U.-P., C. P., Bengal, Bihar, Bombay. The Punjab are well represented in the Industrial Section, though their contribution (except of the C. P., Assam, and Burma) to the Agricultnral Section is practically nil. To make even a cursory mention of these exhibits will increase the length of this article beyond all limits. Suffice it there-

fore, to say that the time and energy spent in studying them will not be wasted, and the knowledge and information gained will be of considerable use to the visitor to what-ever walk of life he may belong.

Now we turn our attention to the Agriculture Section. This section of the Exhibition is divided into two parts. The first part is on the main Exhibition grounds and the second is across the river Gomti. In the main Exhibition there are three pylons which contain exhibits and demonstrations showing the re-search, propaganda, and other activities of the U. P. Agriculture and Veterinery Departments. The first pylon contains the exhibits of the U. P. Agriculture Department of Indian States, and of other Provinces and of the U. P. Fruit Development Board, Marketing Section of the Govt. of India and the Indian Central Cotton Committee.

The U. P. Agriculture Department have shown by the help of their exhibits, charts, diagrams, posters models, and improved varieties of seeds, the organisation and working of the Agriculture Department and its activities throughout the whole length and breadth of the Province. Then they have shown the improvements brought about by them in various agricultural crops. They have been most successful in improving the Sugarcane and the samples of improved varieties of sugarcane placed in the exhibition prove this beyond the shadow of all doubt. The Department has also successfully tackled the problem of improving the antiquated and age old process of Sugar and Gur manufature, which involved waste of fuel, time, energy and inspite of all this wastage produced both Sugar and gur of low quality and full of impurities. The Department has also produced wheat which gives a higher yield of produce per acre and is also rust-resisting. The Department is also trying to introduce in the Province P12, and P4 wheats. The samples of rice exhibited are claimed to give a higher yield and are more finely scented than the local varieties. The department has also devoted its attention to other products such as lesser millets, pulses, oil-seeds spices, tobacco etc. But from the exhibits it appears that in respects ofthese crops their efforts have not so far resulted in any marked improvement of quality, yield, or resistance to disease. Samples of improved vegetables and fruits are also exhibited and the agriculturists are called upon to adopt them.

The charts and graphs have been prepared with great skill and labour, and they impress upon the visitors without strain the work done and the results achieved by the Department in its different activities. They are of special use and utility to students of agriculture. For example

Chart No. 1 shows sugar manufacture in the U. P. by different processes. No. 2 illustrates the comparative percentage yield of sugar to cane in improved and deshi varieties. Chart No. 3 shows the history of the progress of improved varieties of sugarcane giving 50% more tonnage and sugar contents in the Province during the last ten years. Another graph shows the percentage of oil contents in the various oilseeds. Next one shows the percentage of Nitrogen in oilcakes and the oil pressing processes in U. P.

The Agricultural Engineering Section have, with a view to demonstrate the utility of improved methods of agricultural engineering to the cultivators, arranged exhibits of practical value approximating to the actual conditions. All the exhibits have models and charts suitably arranged. An attractive chart giving important details of standard sizes of tube-wells is worth careful study, as it deals with the economics of tube-well irrigation. In the Rockery a small tube-well has been prepared which is provided with an airlift pumping plant which supplies water to the rock garden, the apiary, and the dairy. Adjacent to the tube-wells are charts relating to an oil engine installation of a tube-well. Next to the rock garden there are shown the different stages through which the water-lifting appliances have evolved, viz. Dhanklie, Beri, (Basket-lift), Charsa, and the Persian wheel which is the ideal appliance for irrigation. In the Irrigation court a large tube-well worked by an electric motor plant has been constructed in the same manner as a State tube-well. By its side instructive charts indicating the lay out of an electrified tube-well installation, hydrographic details of the districts in the Hydro-electric Grid area and coloured boring charts of a few tube-well sunk in this grid area have been displayed. The tube-well system has so far failed in our Province, but here it has proved very successful and every year an increasing number of tube-wells are being sunk. Moreover on account of the development and extension of the Grid Electric system, power can be supplied at a very cheap price for the working of these tube-wells, so that in those districts of the Province in which cannals cannot be constructed these have proved to be a great boon to the agriculturist.

Next we came to the Marketting Section of the U. P. Govt. This Department has classified its exhibits in the following sub-sections :—(a) Weights and Measures ; (b) Oil-seeds ; (c) Animal Husbandary Products ; (d) Ghee; (e) Tobacco ; (f) Fruits ; and (g) Cereals. In the Weights and Measures sub-section we see various kinds of defective weights and measures weighing appliances, which have been siezed by the officials of this

department from dishonest dealers. We also see different kinds of weights and measures used all over the Province and their number at once convinces one of the neccessity of bringing about the standardisation of weights and measures not only in this Province but in others as well. The oilseeds subsection's, charts show the charges and expenses incurred in the marketing of oil-seeds by the cultivators. For example one chart shows that the actual marketing charges on a consignment of groundnuts sent from Madhogunj to Cawnpore absorbs 20% of the price received, which is decidedly very high. But in some other cases the charges are still higher which fact proves that something will have to be done which will reduce these charges and thus enable the cultivator to receive a fair price for his products. In the Animal Husbandry Products section importance has been mainly given to the marketing of eggs. By means of charts the visitors are shown the gradation of eggs according to weight, the chief centres of production and direction of movement of eggs in winter and summer in the U. P. In the Ghee section it is shown that due to lack of proper marketing there is lot of sale of adulterated and inferior grade ghee, which robs the purchaser of his money and also of his health. The tobacco sub-section illustrates the different grades of tobacco cured for the manufacture of Khamira for Hukka tobacco. The Fruit sub-section contains samples of fruit, both Foreign and Indian, such as apples, oranges, etc. It also shows the packing material such as pine-needles, Moss-grass, softened pine-needle, wraping paper etc., the use of which will markedly lesson the damage and deterioration of fruits during transit. The last sub-section viz. Cereals shows the importance of different varieties of wheat from the point of view of milling quality. They have also kept samples of different kinds of wheat products such as flour, suzi, bran, maida, murmura, chura, sewaiyan, etc. A chart shows the percentage price structure of rice and export and import of rice in husk and rice not in husk in the U. P. This finishes the Marketing Section of the U. P. Government. Next we come to the stalls of the Provinces of Burma, Assam, the C. P. and the Indian States, whose exhibits though less in number are in no way less important. Burma has sent the different types of tobacco and paddy. Assam has sent samples of potatoes and oranges. The States have sent seeds of their main staple crops and also samples like the thornless Cactus, which is used as fodder. I need not say much about our own exhibits, but by way of comparison I must say that our Province easily scores over others including the U. P., in respect of improvement of Sann fibre, chillies and groundnut. The Sann hemp fibre sent by the Powarkheda

Farm is the longest of all the fibres exhibited. And similar is the case with chillies and groundnuts. The oranges decidedly form a class by themselves, and it is no exaggeration to say that they are many times better in taste (though not in appearance) than both the Sylhet variety and the Sunkissed variety of California and also of Scicily.

At the end of the pylon is the stall of the Indian Central Cotton Committee. In respect of cotton it represents all the cotton growing Provinces. It displays the improved varieties of cotton of all Provinces. The fibre qualities such as length and strength of the fibre are demonstrated by delicate instruments such as Ball's Sorter, Laboratory Staple Apparatus, O'Neills Hair Tester, Modified O'Neills' and Magazine Hair Tester. The improvements in respect of yield, quality and resistance to such pests as spotted Ball-worm, are brought to the notice of the public through the distribution of free leaflets to the visitors.

Near to this pylon is another interesting exhibit known as the village Housing Demonstration," where cultivators are shown how they can build a cheap house with a fire-place, washing-place and ventilators. The models of the improved type of houses are arranged to form a village, which satisfies a reasonably high standard of sanitation. On the outskirts of this model-village there are some model orchards, showing how fruit trees should be planted.

The second pylon contains exhibits of all the research sections, such as Chemistry, Botany, Plant Pathology etc. This section has been richly furnished with innumerable graphs, charts, photographs, pictures, show-cases containing mounted agricultural pests. The agricultural pests have been unearthed in all their myraid varieties, and have been carefully mounted to show their stages of growth and development. The pests of sugarcane, wheat, Cotton, Potato, Tobacco, juar, and of such fruits as citrus, lemons, oranges, and of vegetables such as cabbages, cauliflowers, sweet potato, potato, etc. are mounted and prominently displayed so as to catch the eye of the visitor without fail. The precaution necessary to be taken to safeguard the crops and vegetables and fruits from these pests and the measures by which they can be eradicated have been clearly described on card-boards which are fixed near the specimens of these pests.

The Economic Botany Section deals mainly with cotton, wheat, and barley of the U. P. This section has been successful in producing long staple cotton as C520 by Selection and C402 by Hybridization. Further

they have crossed an awnned variety with an awnless one and have thus evolved a C13 wheat which though previously was awnless, is now converted into awnned variety, which is not liable to be damaged by birds and animals. This is claimed to be the best wheat of the Province. They have also produced improved strains of barley, the most important of which is said to be No. 25 barely which combines the quality of high yield per acre with that of Malting.

The third pylon contains exhibits of Animal Nutrition, showing various grasses and fodders, and also the Veterinary Section's exhibits, relating to animal diseases and animal health. Close to this pylon are the Dairy and the Apiary. In the Dairy one can see up to date machinery and appliances. There is also a Milk Bar attached to it, where milk is served in various forms. The following Dairy appliances are of special interest: Ice-cream freezer, Ice-cream storage, combined separator and clarifier and patented Ice-plant making opaque ice.

In the Apiary are shown the process of domestication of wild bees, for the production of honey. The bee-keeping industry holds out a bright prospect for the future, and it is of special importance to note that this industry does not require a high outlay and solves the most difficult problem of the poor Agriculturist of India. In fact all the articles required for it can be obtained with an outlay of less than Rs. 20/-.

Next thing to draw our attention is the Sugar Court where new and scientific processes of sugar and sugar making are demonstrated. There are three kinds of furnaces viz, the Poona Triple furnace, the Bihar furnace, and the furnace for the new method of the manufacture of white sugar, the use of which greatly economises the expenditure of fuel and also shortens the time required for the manufacture of sugar. Another especiality is the preparation of Activated Vegetable Charcoal from paddy husk which is used for refining the juice of sugarcane before boiling. By undergoing this process the juice becomes crystal clear, thereby eliminating the necessity of using Bhindi juice etc. This section is also trying to solve the problem of utilization of molasses, which either runs to waste or fetches very low prices at present. One of the uses to which molasses is being experimented to be put to, is as Cattle Feed. Another is using the molasses for making roads. There are many roads within the Exhibition Grounds, made of mollasses mixed with other road-building materials. But these are still in the experimental stage though success seems to be quite assured.

Nearby is the large area occupied by the Canal Department. There is a hydro-electric irrigation Model Room showing models of head-works of the Ganges, Sarda Canals, Jagpura Syphon, Hydro electric grid model of a part of the grid area showing tube-wells and a model of Slawa power-house. There is a model room for sugar factory hydel machinery, tube-well area research room for experiments on canal water.

The Trans-Gomti Agricultural Section is chiefly concerned with the demonstrational aspects of Agriculture. The chief points of interest are the demonstration of tractors of different types, from the large Girotiller to the small rubber-tyred tractors. The first prepares the ridges for sugar-cane plantation while the others are used for lighter work. Crops such as Clover, lucerne and sunflower have been grown on the fields with the object of demonstrating to the cultivator the superiority of these fodders from the point of view of nutrition and cheapness. In the Veterinary Section there is a fine display of horses, cattle, sheep, goats and poultry. The Mission Poultry Farm of Etawah has opened a model farm which accommodates a number of fowls and is equipped with all-metal tick-proof houses, trap-nest, yards, etc. The three breeds which have been found to flourish best in India are the Rhode Island Reds, White Leghorns, and Black Minorcas, are exhibited. All kinds of improved farm machines have also been exhibited. One of them is the winnower made by Messrs Girdhari Lal & Sons of Hoshangabad. Another is the Cunning's winnowing and grading machine. I must say that the latter is superior to that of Girdharilal Mistry, though its price is more or less the same.

The last though not the least important section of the Exhibition is the Amusement section which is claimed to be the best organised and bigger than any one ever assembled in India. There is also an Art Gallary to satisfy the aesthetic sense of the visitors, and it contains some of the best paintings of the modern artists of India.

In conclusion, I take this opportunity of expressing my thanks to the Department of Agriculture C. P. for providing me the necessary facilities for seeing the Exhibition of which I have merely tried to mention the most salient features. In fact, the Exhibition is encyclopediac in extent and covers all the various aspects of Industrial and Agricultural life of India.

AGRICULTURAL COLLEGE DAIRY HERD

History and development of the dairy herd.

BY S. K. MISHRA L. AG.

COW SECTION

Object.—The object governing the breeding practice at the College dairy has been the production of a good milking strain, of which the male progeny would provide work stock of sufficient weight and at the same time possess reasonable speed.

History and development.—The herd was started in the year 1912. For some years the stock was entirely Indian bred—mostly of the Hansi-Hissar type. The original bull was a Hansi-Hissar. The average yield per animal was less than 2,000 lbs in the lactation *i. e.* two or three seers per day, a yield which was much too low to offer any hope of running the dairy as a profitable concern. With the object of improving the milk yield an Ayrshire bull was imported in the year 1916, and the result was a very marked increase in the milking capacity of his progeny as compared with that of the dams. The increase in the milk yield of the progeny ranged from 100% to 200%, the males got were of good stamina and provided excellent fast moving work stock. With the exception of their inability to do heavy work in the hotter part of the day in the hot season, they were as effective as any on the College Farm and better when work calling for speed, as for instance hoeing, was concerned. Though physically fit, the animals were easily susceptible to the common Indian live stock diseases. The orginal foundation stock of Indian cows was gradually sold off as the number of cross-bred cows increased.

The second step was to breed a few of the half-Ayrshire stock again to the Ayrshire bull, in the hope that the progeny of this mating being three quarters Ayrshire, would show a still greater advance in milking capacity. The three quarter-breds were not particularly successful as milkers and were markedly lacking in constitution. The males also did not prove to be successful bullocks.

The third step was to breed a few of the half-Ayrshire cows with the bulls of the same extraction but as expected, many variations were produced in the progeny and this process was given up after a short trial.

The fourth step was to mate the half-bred Ayrshire Hissar stock to a pure country bull of a breed which would be likely to maintain the

milking qualities already introduced by the Ayrshire strain, and to improve the stamina and the disease resistance. The bull used was of the Montgomery or the Sahiwal breed. The results of this step were satisfactory and the strain which may be described as ½ Sahiwal ¼ Ayrshire ¼ Hissar was effective.

The milking quality of the females was good and in course of time increased to the level of the half-bred dams. The bullocks from this progeny, were good type of plough stock with an average weight, when full grown, of 825 lbs, height to wither 50¼ inches, leg length up to elbow 29¼ inches and girth 67 inches whereas the average malvi bullock on the farm, weighed 865 lbs, was 52 inches, high leg length being 29 inches and grith 68½ inches. They were not so speedy as the half-Ayrshire males, but certainly less sluggish than the pure bred Sahiwal. Their resistance to diseases was distinctly better than the ½ or ¾ bred Ayrshire.

The fifth step was to interbreed the progeny of the 4th stage *i. e.* a few cows of the ½ Sahiwal. ¼ Hissar and ¼ Ayrshire strain were mated to bulls of the same extraction with a view to establish a breed if possible on a ¾ Indian and ¼ Ayrshire basis. This was expected to result in females with a higher standard of yield and better work stock for the farm work. Three bulls were tried two of which were unsuccessful in stamping the desirable characteristics. Their progeny were markedly mixed and generally of poor physique. The third bull succeeded in producing a greater uniformity in his descendants and transmitted the desirable characteristics to them. The males proved to be good work-stock and the female calves have given good yields of milk on the lines of their dams. This step which was purely experimental, had to be given up without a full trial, as it involved keeping of a large herd for the purpose which was not possible. The herd had to be reduced by the sale of a large number of animals in the year 1931-32 on account of general financial stringency.

The sixth step was to mate a few of the cows of the ½ Sahiwal. ¼ Ayrshire and ¼ Hissar strain to a pure Sahiwal bull. As was expected the females in the resulting progeny gave indications of better milk-flow but the males developed towards the heavy slow moving and locally undesirable type. This step therefore was also given up. The present and the seventh step is to grade up all the animals towards the pure Hissar by heading the herd with a pure bred Hissar bull of reputed milking antecedents with a

view to maintain the high milk-flow and to produce desirable fast moving bullocks. Two of the female progeny of this stage have come in their first lactation during this year and have started with 15 to 21 lbs milk per day. This indicates that they would be good milkers and would maintain the level of the milk-yield of their dams. The males are expected to be good work-bullocks.

To keep down expenses, the present policy is to rear only sufficient female calves to keep the milking herd up to strength, and to dispose of all surplus young stock at the earliest opportunity. On an average, 20 to 24 home-bred cows are kept in the herd and 3 to 4 female calves are expected to replace the older or the inefficient animals each year. The general tendency has been towards the selection of stock with 9 to 10 months milking period, a high average milk yield and a 2 to 2½ months dry period. The better milkers start with a milk flow of 30 to 40 lbs per day, yielding 5,000 to 6,000 lbs in a lactation. The overall average of milk per animal per day including the dry period of animals comes to 11.90 lbs for the year 1936, as against 3.64 lbs for the year 1914.

BUFFALO SECTION

This herd was also started in the year 1912. The original animals purchased from time to time according to the requirements of the teaching and the butter trade, belonged to Murrah and Surati breeds. A combination of cows and buffaloes has also been useful in balancing the milk output during the different seasons of the year.

The present herd is for the most part of ¾ Murrah and ¼ Surat origin. There are a few belonging to pure Murrah breed. The present bull is a pure bred Murrah and the ultimate object is to grade up the mixed stock to Murrah. On an average 12 home-bred buffaloes are kept in the herd and two to three female calves are expected to replace the older or the inefficient animals each year. The surplus young animals are disposed of at the earliest opportunity. As with the cow-herd, the general tendency has been towards the selection of animals with high milk flow and shorter dry period. The better milkers start with a milk flow of 28 to 30 lbs per day, yielding 5,000 lbs milk in a lactation. The over all average of milk per day per animal including the dry period of animals for the year 1935-36 is 9.90 lbs as again 7.73 lbs for the year 1914-15.

General remarks about the herd and records.—The milk-yields of the individual animals belonging to both herds are recorded at each milking

and records of performance and pedigree of all the adult animals are maintained in a standard manner. Fat tests of the milk of buffaloes have also been recorded.

All the calves have been successfully weaned at birth, and pail feeding has been successfully done.

Dehorning has been successfully tried in the past as an experimental measure.

Servings of the animals have been successfully regulated so as to get as far as possible uniform flow of milk throughout the year.

All animals have been fed according to the scale fixed on the basis of the feeding experiments done.

CULTIVATION OF SWEET POTATO.

By B. S. Rao L. Ag. (Honors).

Botany.—Natural order Convolvulaceae.

Botanical Name.—Ipomea Batatas.

The Sweet Potato is a trailing herbaceous perennial with eidible starchy tubers. The stems grow to a considerable length and root freely at every node that rests on the ground.

Habitat.—It is commonly grown as a food crop in tropical regions, with a range of cultivation extending into the sub-tropics.

Soil.—Well drained light soils (Sandy to loamy)

Manuring.—The soil should be rich particularly in Potash as this plant food is very necessary for the plant to be able to manufacture the large quantity of starch which is stored in the tubers.

Too much of Organic matter is bad at it results only in leafy growth. A combination of Organic manures and fertilizers gives good results. 15 cart loads of farm yard manure + 100 lbs Super Phosphate + 100 lbs Sulphate of Potash has very often proved a good combination.

Season.—Sweet Potatoes can be grown throughout the year. But the best crop is obtained as a winter crop. The tubers from the rainy weather crop are generally diseased. It is expensive to grow during the hot weather. In order to supply Vines for planting, a small area will have to be kept under Sweet Potato, throughout the year.

Cultivation.—Deep cultivation is necessary for the proper development of tubers.

Lay out.—The land should be laid out into ridges 2 feet apart, if the soil is loamy. If the soil is on the stiff side, raised beds 2½ feet wide separated by deep channels 18 inches wide will be more effective. On sandy soils planting may be done in check beds particularly during the cold weather when stagnation as a result of heavy rainfall does not occur.

Propagation.—The crop is propagated vegetatively. From healthy vines "cuttings" or "slips" are made each slip having 4 to 6 nodes. While planting, the two middle nodes are burried in the soil at a depth of 2 or 3 inches leaving the nodes at the two ends free above the ground. The nodes which are inserted in the soil root freely and produce the tubers while the nodes above ground will develop shoots. For planting, apical, and middle portions of healthy vines should be selected. When vines are not available, the small tubers may be planted in a nursery and the shoots arising from these made use of for planting. Bottom portions of vines are not suited. The apical sets send forth shoots earlier which grow more vigorously.

If on ridges, slips are planted on either side of a ridge 2 ft apart in such a way that plants alternate on both sides of the ridge. Plants on any one side will be 2 feet apart.

If on raised beds, sets are planted in two rows each row running at a distance of 6 inches from the channel. Planting is done alternately as in the case of ridges.

The winter crop is planted in October and harvested in March or April.

Care during growth.—Loosening of the surface soil and eradication of weeds are necessary. The vines should be turned over from time to time as otherwise the nodes, which touch the ground send down roots, which begin to develop small tubers which are useless. Tubers should be formed by the nodes which have been inserted in the soil while planting.

Tubers should not be exposed as they will be attacked by beetles. It is advisable to heap some earth round the stem to prevent the attack of beetles.

White ants attack the tubers if they are left long in the field. Castor cake used along with the irrigation water will act as deterrant. Rats also do a certain amount of damage. Special measures will have to be taken to keep away pigs.

Irrigation.—The land should be irrigated 2 or 3 days before planting so that the sets may be properly inserted. The plots should be irrigated once as soon planting is done. Subsequent irrigations depending on the nature of the soil and the season are given once every 8 or 10 days.

Harvest.—The crop is ready for harvest when the leaves begin to turn yellow. A few tubers should be lifted and examined. If left too long in the soil they become fibrous and coarse and are also liable to be damaged by rats and white ants.

Harvesting is done by removing the vines first and then turning the land by means of digging forks.

Outturn.—Yields as high as 12,000 lbs have been reported from Poona. But an average yield would be about 7,000 to 8,000 lbs.

The Sweet Potato vines form valuable fodder. They are more digestible and have a higher feeding value than guinea grass. About 4 tons of fodder are obtained from an acre. The Vines do not contain any poisonous ingredients.

Varieties.—Two varieties are cultivated. The red skinned and the white skinned. The red skinned variety is considered to be sweeter.

Labour requirements for some of the operations

PER ACRE

Operation.	Men.	Women.	Bullock pairs.	Time.
Ploughing with a turn wrest plough ...	3	...	2	3 days.
Bakharing ...	1	...	1	½ day.
Making ridges with a ridging plough 2 ft. apart ...	2	...	1	½ day.
Making check beds 9 ft. x 9 ft.	2	...	1	½ day.
	6	...	...	One day.
Making raised beds ...	2	...	1	4 hours.
	6	...	...	½ day.
Spreading 20 cart loads manure.	...	4	...	One day.
Cutting Vines into sets ...	...	3	...	One day.
Planting sets ...	...	6	...	One day.
Removing haulms ...	4	...	...	One day.
Lifting tubers with forks ...	25	...	...	One day.

The tubers and fresh vines of the Sweet Potato show the following analyses.

Stuff	Dry matter	Protein	Fat	Fibre	Ash	Nitrogen free extract	Water.
Tubers	39.1	1.6	0.5	0.9	1.0	27.9	68.1
Vines	17.0	2.1	0.8	3.1	1.5	9.5	83.0

The tubers contain 10 to 20% Sugar and 16% of starch. Sugar and alcohol may both be prepared from the tubers. But the low yield of tubers per acre compared with Sugarcane renders it uneconomic to use Sweet Potatoes for the manufacture of Sugar or alcohol.

Extracts

SOME METHODS OF SOIL MANAGEMENT*

By D. V. Bal

Agricultural Chemist to Government, Central Provinces, Nagpur

Introduction.—The term 'soil management' has been assigned a very wide meaning and it includes various aspects of crop growth in relation to the soil, *e.g.*, formation of soils, physical characteristics of soil, plant nutrients present in the soil in relation to the requirements of various crops, biological relationships existing between the soil and plant and many other aspects which find a place in a treatise on the subjet of soil management. As it is not possible to deal exhaustively with the subject of soil management in an article like this, it is proposed to restrict attention only to those aspect which concern the production and conservation of plant food in the soil moisture and soil amelioration. This article does not necessarily deal with new or novel methods of soil management, but it is hoped it will emphasise the urgent need of practising some of the important methods which have been evolved recently or have been known for some time, but are either not practised to the desired extent by the cultivators or have fallen into disuse for unknown reasons.

General requirements of crops.—Plants require for their growth substances like carbon dioxide, water, exygen, and suitable compounds of nitrogen, phosphorus, sulphur, calcium and magnesium. Of these carbon dioxide is obtained from the atmosphere and some, like calcium and sulphur though taken in large quantities are ordinarily present in sufficient quantities in average arable soils. . Special cases are however met with where the lime status of the soil is required to be adequately maintained by artificial methods. Nitrogen, potassium and phosphorus compounds which are also required by the plants in large quantities are however generally present in inadequate quantities in Indian soils and are therefore required to be supplied to the soils in order to obtain better crop yield.

In order to make the land yield the maximum outturn, it is not only necessary that the soil should contain the required elements in sufficient quantities, but it is also necessary that the physical condition of the soil should be such as to facilitate good root growth by regulating air and water-supply.

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Importance of organic matter in the soil.—The physical condition of the soil depends upon the presence of right proportions of various mechanical constituents like clay, silt and sand in the soil in relation to the climatic conditions, and in addition an adequate proportion of organic matter and lime. Indian soils, in general, are deficient in organic matter. This may partly be due to the rapid decomposition of the organic matter under the conditions of high temperature prevailing in India, and partly to the fact that most of our soils have been under cultivation for centuries, without adequate return of organic matter to the soil in the form of cattle manure or crop residues.

An adequate amount of organic matter in the soil is absolutely essential in order to bring the soil into the required state of tilth and for the better utilisation by plants of the fertilising constituents they may be present in the soil or which may be added in the form of artificials. In view of the fact that organic matter performs a most important function in maintaining the right physical condition of the soil and promoting many beneficial biological activities, we shall first consider some of the methods which help to increase this important constituent in the soil.

Easy methods of increasing organic matter in the soil.—One of the usual methods known to the cultivator and practised by him for many years is to apply farm yard manure to the soil. Avery large quantity of the available cow-dung is however normally used as fuel by the cultivators and this practice is bound to continue till an alternative source of fuel becomes avilable. There are, however, various other methods by which organic matter can be added to the soil as described below:—

(1) Organic matter added to the soil can produce beneficial effects only when it does not differ widely in composition from natural soil organic matter or humus. This can be achieved by adapting methods which can convert various types of organic waste products of the farm into artificial farm yard manure, and incorporating the latter with the soil. Since the original work of Hutchinson and Richards was published in 1934, efforts in this direction were made by different agricultural investigators in India, and suitable methods have now been worked out for the preparation of artificial farm yard manure. Details of these methods suitable for any particular tract can be obtained from the departments of agriculture concerned. Various types of waste materials like dry leaves, stalks of cotton, pigeon pea, sann-hemp and *ambadi*, weeds from the fields and waste lands, old thatching material, inedible fodder and various kinds of

stubble, are usually available in large quantities and if these materials are properly utilised the cultivators can enrich their fields in organic matter and thereby improve the condition of the soil, and thus obtain increased crop yields.

Trials conducted at Indore [Jackson *et al*, 1934] have shown that the permeability of black cotton soils is nearly doubled when dressed with compost. Its application also increased productivity of black cotton soil and maintained a steady supply of nitrified nitrogen both on black soils and sandy soils.

(2) Material known as "gutterfly" which is available in large quantities from cotton spinning and weaving mills has been found to be very valuable as organic manure. Gutterfly consists of the residue obtained when cotton bales are opened and passed through the blower. It usually contains about 80 to 85 per cent of organic matter and about 1 per cent nitrogen. This can be applied to *rabi* land directly during summer, by spreading it on the land and leaving it to get thoroughly moistened by the rain, thereafter turning under as opportunity offers. The Nagpur Agricultural College Farm started using gutterfly as a manure many years ago, and experience has shown that, with adequate moisture, it is completely decomposed in about two to four weeks after burying in the soil. For the *kharif* crops the usual farm practice is to use either well rotted gutterfly or else the material is spread and ploughed in just after the harvest of the preceding *kharif* crop, *i. e.*, between November and January. The winter rains usually suffice to bring about the rotting, but if no winter rain is received sowing of the subsequent crop is some what delayed. Addition of gutterfly has been found to improve remarkably the condition of the soil and the crop yields, and it is therefore recommended that cultivators in the vicinity of cotton mills should make use of this valuable material for the improvement of their fields.

(3) In addition to the above two sources of organic matter there is yet another important source, namely, green manuring. The value of green manure as a source of organic matter has been known to the cultivators of China and European countries for over five hundred years but it is only since the nineteenth century that general interest has been shown in this subject and today the practice of green manuring finds favour with many cultivators outside India and is very commonly adopted by them to enrich the soil in organic matter. Ordinarily, green manuring means turning under undecomposed plant material either

grown *in situ* or brought from the adjoining fields. The former method can only be adopted in *rabi* lands, or in fruit orchards when the plants are small and the soil requires to be enriched with organic matter. In the case of *rabi* crops, from the experience gained in the Central Provinces, Allan [1915] has shown that at least twelve to sixteen inches of rain must be received after the inversion of the green crop so that there may be sufficient water to bring about the proper rotting of the organic matter and also to support the subsequent *rabi* crop. For *rabi* lands sann-hemp has been found to be a suitable green manuring crop as it is quick growing, adequately leafy and soft and hence susceptible of quick decomposition in the soil. It also possesses a very high nitrogen-fixing capacity and hence it is very helpful in recuperating soil nitrogen. Experience on the Nagpur Farm has shown that even when sann-hemp is grown as a fibre crop, the subsequent cotton crop gives a far better yield than that grown in a field previously cropped with either cotton or *juar*, owing to the effect of organic nitrogen added to the soil as a result of sann-hemp leaves falling on the ground and the root residues left therein. In order to conserve the added organic matter and nitrogen in the soil a light cultivation with the *bakhar* is usually given after the sann crop is harvested so as to incorporate the organic matter with the soil.

In paddy tracts where transplantation is practised, the *rabi* land may be utilised for growing the green crop, which may be cut and added to the rice fields at the time of transplantation. Grasses and other vegetation growing on the *bunds* may also be utilised as above, thus securing a two-fold advantage of enriching the land with organic matter and of clean cultivation. In this connection, it must be mentioned that if the green manure is applied either one or preferably two weeks before the date of transplantation of the rice seedlings, the yield obtained is considerably higher than that obtained when the green manure is incorporated with the soil at the time of transplantation.

If perennial or annual quick-growing legumes like varieties of *Sesbania* and *Erythrina* are grown on the *bunds* of rice fields, borders of *kharif* and *rabi* fields, and on available waste areas, large quantities of useful green manure and fuel can be easily secured without any extra expenditure, and in addition the deep rooted trees would thus help to extract nutrients from the subsoil and bring them up to the surface.

Another important source of organic matter is human excreta or night soil which, if efficiently utilised as manure, would prove of immense

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value in enriching the soil. The importance of this material as a soil-fertilising substance has long been recognised, as is evident from the high prices offered for land situated near the village sites which gets highly fertilised and gives higher crop yields than those obtained from ordinary fields away from the village. Although the value of night soil is recognised its use as manure has been entirely neglected partly on account of the distasteful task of applying it to the land and partly due to caste prejudice and conservatism. By applying modern methods of sewage purification an odourless material can be manufactured, and wherever such material is available the cultivators should cast off their prejudices and come forward to utilise this valuable organic material. Even in rural areas where elaborate modern methods of sewage disposal are not practicable, simple and inexpensive methods like the 'earth-closet' system or the 'movable latrine' system can be easily adopted. In these days of severe competition, unless and until the natural manurial resources of our country are utilised to the fullest extent, we cannot expect to get crop yields of the same order as those obtained in Japan, America, and on the Continent. It is quite a common practice with many educated but non agricultural persons of our country to compare the crop yields of India with those obtained in Japan or America and deplore the state of our country in this respect; but the explantation for this is not very far to seek. While every one wishes that the crop yields, say of paddy of our country should be as high as those obtained in Japan, we want neither to exert ourselves even half as much as the Japanese cultivators do nor do we want to make full use of the available natural resources of organic manure which the Japanese cultivator uses to the fullest possible extent without any prejudice what so ever. In other words he follows his profession whole-heartedly and conscientiously.

In addition to the various factors discussed above, there is one more important method of conserving soil fertility, *i.e.*, the practice of proper rotation. Continuous cropping with the same crop year after year produces the following important effects, which tend to lower yield of the crop:—

(1) Soil is cultivated to a uniform depth so as to suit the requirements of a particular crop, which may result in the formation of a hard layer at a particular depth in the soil which would interfere with the penetration of the plant roots.

(2) Certain weeds adapted to live among a particular crop get a chance to establish themselves and thus may seriously infest the field after a time.

(3) Certain diseases and pests find favourable conditions to establish themselves and infest the crop with increasing intensity year after year.

(4) Soil may get exhausted of certain plant food constituents partly because these are required in appreciable quantities by the crop, and partly because the root-system of a particular crop being of a fairly uniform type the roots penetrate into the soil only up to a certain depth.

In order therefore to maintain the yields of farm crops and also to maintain the soil fertility, growing different types of crops in rotation has been found to be successful in most parts of the world. Choice of crops required for this purpose will depend upon the climatic and economic conditions of a particular tract, but a wide range of crops is usually available, from which suitable crops can be selected. The importance of introducing a suitable leguminous crop in the rotation to be adopted cannot be over emphasised. In the cotton tract of the Central Provinces, *e.g.*, a three course rotation of 'cotton—*juar*—groundnut' has been found to be most suitable. In this type of rotation there is a threefold provision of a money crop of cotton, a fodder and a grain crop of *juar*, and a soil recuperating crop of groundnut.

Experience in the Central Provinces has also shown that wheat grown in rotation with legumes gives a better outturn than when it is grown without any rotation or in rotation with non-legumes.

Artificial fertilisers.—Having dealt with the question of supply of organic matter to the soil and its conservation at some length, we shall briefly consider the question of supply of the three important nutrients, *viz.*, nitrogen, phosphorus and potash which have been referred to in the beginning. Out of these three, nitrogen appears to be pre-eminently the limiting constituent in the soil and applications of nitrogenous fertilisers, therefore, often give spectacular results, and are for this reason somewhat more popular with the cultivators than the phosphatic or potassic fertilisers. So far as the cotton crop is concerned, either sodium nitrate or ammonium sulphate, depending upon climatic conditions, can be usefully employed. Ammonium sulphate, though more safe than sodium nitrate as it is not leached out of the soil by washing, does not always give the best results. During the monsoon, for example, it has been observed several times that after long continued rainfall, waterlogging takes place and the natural process of nitrification in the soil is checked and the plants become stunted and yellow due to deficiency of available

nitrogen. Under such conditions it has been found that the plants regain their lost vitality very quickly, become green and throw out new growth after a top-dressing of nitrate of soda.

Ammonium sulphate is not absorbed as such by a majority of crop plants as its nitrogen is required to be converted into nitrate with the help of soil bacteria. Under conditions of adequate moisture in the soil, ammonium sulphate will therefore be more advantageous than sodium nitrate for the following two reasons :—

(1) As already mentioned above, nitrogen from this fertiliser is held very firmly by the soil and is not therefore leached out of the soil.

(2) As the nitrogen is gradually converted into the available form of nitrate, a steady supply of this constituent is available in required quantities for a long time during the growth period of the crop.

Phosphatic fertilisers do not appear to give any spectacular results with ordinary crops and although their use may improve the quality of the produce and vigour and disease-resisting capacity of the plants, the advantage thus obtained may not compensate in every case, for the extra cost of the fertiliser employed. Field experiments conducted with paddy on some of the farms in the Central Provinces have however shown that the use of superphosphate or bone-meal along with green manuring is more paying than green manuring alone.

Average soils do not appear to be deficient in potash and hence potassic fertilisers are not commonly used in ordinary farming. Potassic fertilisers on light soils with leguminous crops like groundnut have however been found to be very beneficial. Experiments conducted at Akola [Youngman and Janoria, 1927] with groundnut grown on local black cotton soil have proved that the most profitable fertiliser for this crop is sulphate of potash at the rate of 70 lbs. per acre. The fertiliser should be applied at the time of sowing, being scattered by hand.

Potassic fertilisers have also been found to be very useful for sugarcane. They are reported to improve the quality of the juice by increasing the percentage of cane-sugar and reducing the percentage of invert sugar. Although phosphatic and potassic fertilisers may not show

any spectacular results with ordinary field crops, their importance in vegetable gardening and horticulture should not be ignored and individual cases of garden crops will have to be dealt with separately by giving due consideration to the local conditions of the soil and climate.

Finally, it may be added that the use of artificial fertilisers has not as yet achieved much popularity, not because fertilisers do not show the desired results, but because other factors like poor cultivation, use of local, mixed and some times deteriorated seed, and the world-wide economic depression, affect adversely and mask the effects brought about by the use of fertilisers. It appears rather inadvisable, therefore, for the present to lay any special emphasis on the use of fertilisers as a general practice of soil and crop management, but one feels confident that with improved methods of cultivation and an improvement in the general economic conditions, they are bound to acquire a stable footing in the agriculture of the average Indian farmer.

Regulation of soil moisture.—The consumption of water by the various crop plants is very great and is estimated roughly to be 400 to 1,000 times the dry matter formed by the plant, under tropical conditions of climate. This requirement is reduced to a certain extent if an adequate amount of manure is added to the soil. At any rate it is not enough merely to supply the required quantity of water to the growing plants; it is also essential, as already been mentioned before, that the soil should contain the right proportions of moisture and air, as in the absence of an adequate supply of the latter, the roots get asphyxiated, and stunted growth is the result. The beneficial soil organisms are also adversely affected and consequently there is a deficiency of available plant nutrients particularly nitrates. The concentration of water in the soil which is necessary for good development of crops and the beneficial soil organisms varies largely with the nature of the soil. Leather [1911] found that in light soils ten to fifteen per cent moisture may produce good but not the largest crop growth, whereas in heavy soils like black cotton soil twenty five per cent moisture in the soil is too small for anything but the most meagre growth.

Regulation of soil moisture can be achieved mainly by two methods, firstly, by having recourse to measures which are helpful in reducing to the desired extent the excess of water in the soil, and secondly, by artificial applications of water to the soil to make

up the deficiency of moisture, or by controlling the absorbtion of rain-water and preventing its loss, by proper tillage. In the former case, elaborate methods of under-drainage or the less costly method of constructing *kachha* underground drains can be adopted as desired. Adequate surface drainage, however, is very important and if properly provided for, goes a long way to check surface erosion and the ill effects of water-logging produced on young growing seedlings. For checking surface erosion, a method which has been recently tried and found successful by Howard [1932] is described in the following extract. For fuller details readers are requested to refer to the original article :—

> "The land was laid out in suitable fields, each of which provided with shallow trenches (nine inches deep, five feet wide at the top and two feet wide at the bottom; with sloping sides) and grass borders to remove its own excess rainfall. In this way the aera was protected from outside water, and a rough-and ready system of local drainage was provided for each field. Wherever possible rectangular plots, each eight acres in area, were made. Between every two plots there is, in addition to the surface drain, a grass strip eight feet wide which serves as a fair-weather road for the transport of produce and manure.

> After providing surface drainage, the grading of each individual field had to be undertaken. This was arranged for so that the run-off could reach a drain after it had travelled about 500 feet. If this distance was exceeded water-logging took place. As the standard eight-acre plots measured 898.5 by 390 feet no difficulties were experienced when the field drained shortways. The run-off then reached a drain before any damage was done. In cases where the plots drained longways, an artificial depression about fifteen feet wide and six inches deep in the centre was scraped out (by means of the levellers used in grading) across the middle of the field, so as to intercept the run-off. This artificial trough, in the general surface of the field, communicated at both ends with the ordinary surface drains and served to protect the lower half of each field from the run-off of the upper half. To increase the efficiency of these depression the soil which had to be removed in making them was arranged as a low, broad ridge on the downside of the drain."

Whenever there is a shortage of natural soil moisture, water has to be provided for by artificial means either from irrigation tanks or from wells. When bringing new soils under artificial irrigation, the danger of the soil getting saline due to the rise of injurious salts to the surface from the subsoil by continued use of irrigation water should be guarded against. This can be avoided if proper precautions regarding the examination of the soil and subsoil are taken in time. The various departments of agriculture can give such help whenever required.

When water from a well is to be used for irrigation in addition to the usual examination of the soil, the water should always be examined for its suitability for purposes or irrigation. A number of instances have been met where by the continued use of undesirable well waters for irrigation, the soil has been spolit and the crop has considerably suffered. Some well waters are absolutely unsuitable for irrigation but in many instances with proper methods of soil management, the injurious effect of tolerable types of water can either be avoided or postponed for a number of years.

When well water is of medium quality (*i. e.*, when it contains sixty to eighty parts consist of sodium sulphate and sodium chloride) the effects produced are of a cumulative nature and are of two types: (1) if proper precautions are not taken from the beginning quantities of sodium salts gradually accumulate in the soil at the expense of calcium and this spoils the tilth of the soil. The plants are therefore adversely affected by the undesirable physical condition, and by the direct effect of a high proportion of injurious sodium salts in the soil. (2) If however the soil has an adequate reserve of total and available calcium in it, the injurious effects are very considerably delayed and the situation is further improved if moderately deep channels are constructed at reasonable distances, so that the soluble salts accumulated in the top foot or two of the soil can be washed out with the help of the natural sweet water received during the rainy season.

In order to provide adequate quantities of lime, applications of lime as chalk or slaked lime together with gypsum are recommended. The exact quantity required will differ in individual cases and the advice of the department of agriculture should be sought, whenever necessary. It has recently been seen in many cases that the treatment suggested above has been of material benefit, both for the improvement of ordinary soils deficient in exchangeable and total calcium, and for the better utilisation of tolerable but not decidedly harmful types of well-water by crop plants.

PRACTICAL HINTS ON BEE-KEEPING

THE INDIAN BEE

(From the Director of Agriculture, Madras.)

In these days of economic depression the income from agriculture is poor and the ryot, therefore, has to look to other sources to enhance his earnings. Taking into consideration the poverty of the average Indian ryot and his consequent inability to invest large sums on new ventures, bee-keeping on improved lines can be safely recommended as a paying cottage industry, as it involves only a small outlay. Moreover there is no dearth of bees or of bee-pasturage crops in this Presidency. Preliminary trials have shown that a colony of bees, under favourable conditions, is capable of yielding a net profit of not less than Rs. 15 (Fifteen) per annum and as such there are great possibilities for this new industry.

Selection of bees for rearing.—Enormous profits are derived in the temperate regions by rearing the European bees, but their progress, apart from the prohibitive cost of importing them, has not been very encouraging in this country. Of the indigenous bees, the Rock bee which is the biggest of Indian honey bees and found mostly on the hilly regions is unfit for domestication, because of its peculiar comb-building and migratory habits and ferocious temper. The Little bee also has been found unfit for rearing, as it is migratory in habits and a poor honey gatherer. The Dammar bee, the smallest of the indigenous bees, is also not reared because of its poor honey gathering capacity. The only bee that can, with advantage, be domesticated is the Indian bee. It is smaller in size than the Rock bee and constructs its combs in parallel rows inside natural hollows in tree trunks and in the ground, cracks and crevices in buildings, old pots etc. It is a fairly good honey gatherer and is comparatively mild in temper. The present paper therefore deals only with the Indian bee.

Honey and pollen are the most important bee-feeds. Both of these are available from flowers and the plants that provide these bee-foods are spoken of as bee-pasturage crops. The following are the important bee-pasturage crops observed round about Coimbatore:—

Pollen yielders: Maize, Cholam, Cumbu, Caster, Sunflower, Peltophorum, Zinniah, Palmyrah, Co-coanut, Niger, Cucurbitaceous plants etc.

Nector yielders: Different varieties of cotton, Tamarind, Margosa, Sunflower, Plantains, Niger, Pungam, Raintree, Antigonon, White Babool, Drumstick tree etc.

The bee-hive.—The artificial bee-hive is a miniature house designed to accommodate a bee-colony. There are various types of these hives, but in South India the most popular pattern is the Newton Hive. This consists of a brood-chamber and a super, with a floor board below and a top above. The brood chamber consists of a rectangular box open at the top and bottom and provided with a movable floor board below. It contains seven movable frames to support the combs. The super is a separate compartment meant for storing honey only and is kept over the brood chamber when the latter is full of bees. The top is placed on the brood-chamber or the super as the case may be. Measurements of the various parts are given below :—

Floor-board, 14 inches by 9½ inches.

Brood-chamber-inner measurements, 9¾ ins. by 8¼ ins. by 6¾ ins.

Width of groove along the top of the front and rear planks of the brood-chamber to support the frames, ¼ in.

Entrance to be cut along the lower side of the front plank of the brood-chamber, 3½ ins. by ⅜ in.

Measurements of the Brood-frame :—

Breadth of top bar, ⅞ ins.
Length of top bar, 10 ins.
Thickness of the top bar, ⅛ in.
Inner length of frame, 8¼ ins.
Inner height of the frame, 5¾ ins.
Total height of frame, 6 ins.
Length of side bar, 5⅛ ins.
Width of side bar at the top, 1⅛ ins.
Width of side bar at the bottom, ½ in.

The top bar should be fixed exactly at the centre of the side bar so as to effect a clearance of exactly ⅛ in. on either side. The length and breadth of the super are the same as those in the brood-chamber, but the height is only 3½ ins. Measurements of the super frames also are similar to those of the brood-frames but the inner height is only 2½ ins. The top is made to suit the hive body and a hole is provided in the front and rear planks and a big opening about 3 ins. square in the ceiling

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plank to provide ventilation. Care should be taken to close all these openings with thin wire gauze. After making a few hives the amateur should think of filling these with bees. This can be achieved either by capturing *wild colonies* or by *hiving swarms*. Wild colonies are generally found in enclosed spaces such as hollows in tree trunks, cracks and crevices in walls, old pots etc., and the best way of locating them is by observing the likely places on bright mornings when numbers of bees will be seen going in and coming out of the burrows. Prior to the actual capture of the bees, the entrance should be widened and the combs taken out gently one by one. Good-sized combs having plenty of brood should be selected and fixed to the frames with plantain fibre. The bees can then be induced to come to the hive by capturing the queen in a glass tube and placing it over the frames, after having closed its mouth with a piece of mosquito-net. In the absence of a tube, the queen can be caged in an empty match-box, care being taken to have it partially open. When the majority of the bees have entered the hive, the queen can be liberated. In cases where the queen is not captured, clusters of bees that would by this time have collected inside the hollow can be scooped and transferred to the hive. The queen will invariably be found among these bees. Since the bees are likely to sting when being handled a few occasional whiffs of smoke from burnt rags may be necessary to quieten them.

Hiving Swarms.—Swarms are small groups of bees each with a queen, which issue from established colonies during the honey flow season and settle in some convenient place for a time in the shape of a bag-like cluster. Later on, these bees move away to some convenient place of abode and start a fresh colony. If one has a few colonies, their number can easily be increased by having such swarms and keeping them separate. The capture can be effected by getting a new hive with the frames removed and placing in it a good brood-frame taken from one of the settled colonies. If the swarm is from the particular hive from which the brood-comb has been taken, it can be given with the bees; if not, the bees have to be driven away. In either case, care should be taken to see that there are no queen cells in the comb. The hive should be held in such a way that a major portion of the cluster is inside the box. The bees, being attracted to the brood, quickly transfer themselves to the hive. The remaining frames and the top can now be put on and the hive kept at some distance away from the original colony.

After-care of Captured Colonies.—Wild colonies should, as far as possible, be hived only during the brisk breeding season, since the presence of the brood in the combs induces the bees to settle in the artificial hive. Fresh captures should not be disturbed frequently, except for an occasional cleaning of the floor-board. Weak colonies should be fed with either dilute honey or thick sugar syrup. The frames should be examined after about a fortnight and the pieces of plantain fibre removed. Combs that have been improperly fixed and those that have dropped down must be refixed. The progress of the colony should be carefully watched and if egg-laying is not satisfactory, a brood-comb from another colony may be given. There is always the risk of the bees deserting the hive until they settle down to their normal routine of brisk pollen and honey collection and brood rearing. Such desertions can be prevented by the use of a queen-arrester. This is a simple contrivance consisting of a piece of wood, longer than the entrance of the hive with a shallow cut about one eighth of an inch deep and just as long as the entrance. It is kept close to the entrance with the cut end below. The narrow slit is enough to allow the workers but not the queen and bees do not, as a rule, swarm out without their queen. The same precautions hold good for the newly hived swarms but a few additional old or foundation combs may be given to save the time and energy of the bees.

An Apiary should be started only in a locality where there is plenty of bee-pasturage. Care should be taken to keep the hives absolutely level in a place which is well protected from the hot sun, heavy rains and high winds.

Examinations of bee-hives.—Bee-hives should be opened and examined only on bright mornings when most of the bees are busy. Quick and nervous movements, incidental crushing of bees, etc. should be carefully avoided while handling the frames. The sting is fairly painful but the pain and the attendant swelling can be considerably minimised if the sting, which is left behind, is scraped away immediately. When the bees or in a bad mood they can be quietened by a judicious use of smoke.

Swarming in bees is the natural method of the distribution and perpetuation of their kind. This instinct is very strong in bees and steps should be taken to check the impulse, since colonies get considerably weakened by the frequent issue of such swarms. This family separation

occurs only during the prosperous season but the actual period may vary according to the locality. Prior to sending out swarms, the colonies multiply rapidly and the initial preparation for swarming is evinced by the excessive rearing of drones. This is followed by the erection of queen-cells along the lower border of the brood-combs and a series of swarms issue after these queen-cells are sealed. The most popular method of preventing the issue of swarms is the periodical cutting of the queen-cells. Another method which shows better promise is the destruction of the reigning queen or her removal with a comb of bees to a separate hive after the queen-cells in the original colony are sealed. The colony is kept under careful observation and all the other queen-cells are cut away after the new queen has emerged. The swarming impulse is lessened when the colony remains without a queen for a few days. Neither of the two methods mentioned above can claim to entirely cure the bees of their swarming fever. A third procedure may be adopted, provided the conditions are favourable. If the swarming impulse is evinced early in the honey season the first swarm may be allowed to issue and it may be hived and kept as a separate colony. The rest of the queen-cells should be removed after the emergence of the fresh queen. The owner in this case gets two colonies out of one and both of them may yield honey in the first year itself, if pasturage conditions are favourable.

Owing to adverse pasturage and weather conditions during certain seasons, the queen reduces her rate of egg-laying and the population of the colony dwindles in strength. Under such circumstances, the bees may be fed artificially either with dilute honey or thick sugar syrup, by pouring a small quantity of the fluid over the frames once or twice a week. The feeding may be stopped as soon as a sufficient quantity of honey is found stocked in the combs.

Bee Enemies.—Bee enemies such as the wax-moth, the black ant, the yellow banded wasp, and the death's head moth are very active during the slack season and necessary steps should be taken to check them. Of these the wax-moth is the worst enemy of bees. The caterpillars attack the combs and infested colonies very soon desert the hives. The following hints may be helpful in controlling this pest. All attempts should be made to keep the colony strong as this enables them to withstand the ravages for a longer time. Remove all superfluous combs and stock them in an air-tight recepticle. A mud pot with its mouth sealed with cow-dung serves the purpose quite well. The combs should

be frequently examined and those showing traces of damage should be promptly destroyed. The floor-board as well as the other parts of the hive should be kept clean. Pieces of waste combs should not be thrown about carelessly. Necessary precautions should be taken to see that there are no cracks and crevices in the hive body. The interspaces between the brood-chamber, super and top should be examined for the egg masses and if present should be scraped away. If there is a suspicion that the eggs have been laid in any of the inaccessible crevices, the hive body may be changed frequently. Combs that are stored for the next season's use are also likely to be attacked. The caterpillars infesting these combs can be easily eliminated, by exposing the latter to the morning sun, for about fifteen minutes, taking care to see that the temperature does not exceed 40° centigrade.

An enemy of bees that has to be guarded against is the *black-ant.* These ants are particularly trouble-some after the rains; sometimes causing wholesale damage to bee colonies by snatching away numbers of bees, very often grubs and pupae also. The nest can be easily controlled by dropping a few granules of Calcium cyanide inside the ant holes. The hives can be kept on stands that have been provided with ant-pans. Occasionally bee colonies are visited by *the yellow banded wasp* and numbers of bees are snatched away. The wasps can be hand-netted and killed. Nests of these wasps can also be searched out and burnt during night time. *Death's head moths* occasionally enter bee-hives and steal away a good quantity of honey. Generally the bees themselves kill these moths after their entrance into the hive, but it is better to destroy them wherever they are found.

Since a strong population is essential for gathering plenty of honey, necessary facilities should be given for the rapid increase of bees during the breeding season. Old combs taken out and stored during the previous season may now be given at the centre and if these are not available the combs at the sides, which are generally stocked with honey, may be transferred to the centre. This treatment apart from providing the necessary egg-laying space and stimulating the egg rate of egg-laying by the queen, also saves the time, energy and honey of the bees, which would other-wise be wasted in constructing fresh combs. Since weak colonies do not yield much honey, two or three of them may be united and built up as one strong colony. If this is not desired, the population of a weak and a strong colony can be equalised

by inter-changing the position of the two hives on a bright morning when the bees are working briskly. The super may be added when the bee population has become strong enough to cover all the seven combs in the brood-chamber. The provision of spare combs to the super also is necessary so as to encourage the bees to come up and store honey. If spare combs are not available, the two side combs of the brood-chamber may be taken out, cut to the size of the super frames and fixed on to them.

Uniting colonies :—This operation consists of uniting of two or three colonies into one and it may be done for mixing a queenless colony with another having a queen, uniting two or more weak colonies to make a strong one etc. There are various methods of uniting but the simplest which is popularly known as the "newspaper method", is described below :—The colonies that are to be united are brought side by side (as described under shifting bee colonies) and one of them dequeened twenty-four hours prior to the uniting. Late in the evening the colony having the queen is opened and the top of it is covered with a sheet of newspaper. A few small holes are made in the paper. The floor-board of the other colony is now removed and the hive is kept over the newspaper. All means of escape are now closed with wire-gauze and the two colonies left alone for the night. The imprisoned bees in both the hives, scenting the presence of strangers, begin to investigate by tearing open the holes in the newspaper and by this time the hive odour gets amalgamated and the union of the two colonies is accomplished. The wire-gauze at the entrance of the lower hive can be removed early next morning. The hives can be opened after the weather gets brighter and the frames of both the colonies can be kept together.

It is very common for colonies to lose their queens during the swarming season. This is due to the queens either getting lost or preyed upon by insectivorous birds during their nuptial flight. The absence of the queen is indicated by the slackness of work in the colony. The workers get their abdomen contracted, turn black in colour and they can often be seen remaining huddled together at the entrance. The combs do not contain any worker brood but in most cases, numbers of eggs laid by some of workers, may be found in each cell. Under such circumstances all the superfluous eggs are removed and even transported to other cells by the bees. Since the workers are not fertile the grubs that hatch out of their eggs develop only into drones. The combs get twisted in shape

on account of the unequal pressure caused by the presence of larger drone grubs in the smaller worker cells. In neglected cases numbers of adult drones also will be found. To provide a new queen for such a colony a comb with a scaled queen-cell from another colony may be given, after driving away the bees adhering to it. The bees may sometimes tear away the queen cells and in such cases a new queen may be introduced by the following method.—Dip the queen in honey and drop her into the queenless colony, pouring a small quantity of honey along with her. The workers immediately cluster round the queen and begin to lick the honey. The smell of latter which attracts the bees, probably neutralizes the individual odour of the queen. Therefore by the time she gets rid of coating of honey she is accepted by the colony. If the above methods are not successful, the colony may be united with another having a queen. Whatever may be the method adopted, necessary steps to requeen such queenless colonies should be taken immediately after the loss of the queen is noted; since the bees sometimes refuse to accept either a queen-cell or a queen if there is any undue delay.

Shifting bee colonies.—Bees have a very strong homing instinct. Powers of good perception and a strong memory of the landmarks enable them to fly back to their hives with unerring exactness, from their foraging excursions. When the bees are working briskly, if the hive is moved even by a few inches, it takes a little time for the returning foragers to find out the entrance. If the hive is moved by four or five feet, the bees returning with pollen and nector persistently hover about the original place until they drop down and die of exhaustion. Therefore, if the hive is to be shifted from one place to another within the apiary itself, the moving should be done after sunset by about two feet per day. If it is necessary to shift the colonies to a distance, the entrance is closed with wire-gauze after nightfall and the hive taken to the desired place and the entrance opened. The minimum distance to which the bees can be moved, without any of the workers returning to the original place, is about half a mile. Frequent shifting of bee colonies should be avoided, since it always entails the loss of a number of bees.

Honey and its extraction.—Bees generally collect nectar from flowers, convert it into honey and store it in their cells. After the cells are filled with the requisite quantity of

ripe honey, they are sealed with wax. Honey, should be extracted only after 75 per cent of the cells are sealed. Prior to the extraction, the bees that are found adhering on the honey combs may be driven away by the following method. Take out the frames and keep them in an empty hive without the top and the floorboard. Hold the box in such a way that the top of the front side of the box is just touching the end of the floor-board and apply smoke from below. The bees being frightened by the smoke will all rush into the hive. After driving away the bees, the sealed combs should be uncapped with a sharp knife and the honey extracted in the honey-extractor. The latter consists of a cylindrical drum and a box to hold the honey combs. The box is fixed to a rotating rod at the entrance and the revolution is affected by the action of a set of two gear wheels on the central rod. The frames containing honey are kept in the slot provided in the comb-box and the latter is rotated. After the honey on the outer side of the comb is extracted the frame should be reversed and the honey on the other side taken in a similar way. The box should be rotated gently at the beginning and the speed increased after the weight of the combs is reduced. Heavy combs are likely to break if the rotation is too fast at the beginning itself.

Ordinary bees seal the cells with wax as soon as they are filled with "ripe honey," but occasionally they take a long time to close the cells. In such cases, the honey can be extracted before the sealing, but it has to be ripened artificially prior to storing, as described below:—Pour the honey preferably in an enamel or earthen vessel and keep the latter in a water-bath. The water should be heated up to 150° F., and maintained at that temperature for about half an hour. The water should not be allowed to boil nor can honey be heated directly over fire. The ripening can also be done by exposing the honey in a wide mouthed vessel to the hot sun for about a week. The mouth of the vessel may be covered with a piece of thin cloth to keep off dirt etc. The ripened honey is best stored in glass or enamel or earthen vessels. The recepticles should be closed tightly and kept in a cool and dark cellar.

A few hints for amateur bee-keepers: The following hints may be useful for beginners in maintaining their apiaries successfully:—

1. Make the bee hives without cracks and crevices so as to prevent the wax-moth from laying eggs in these.

2. See that the measurements of and spacing in the frames are correct. Any error will induce irregular comb construction.

3. Hive wild colonies during the brisk season since colonies caught during the slack season invariably desert.

4. Locate apiaries in places where pastorage conditions are favourable.

5. Keep the hives absolutely level in a place well protected from the mid-day sun, rain and high winds.

6. Do not disturb newly hived colonies frequently.

7. If there is not sufficient honey flow feed new colonies with dilute honey in the absence of which sugar syrup or jaggery solution may be used.

8. Give the food inside the hive. If the food is kept outside the hive, it often leads to fighting and robbing among bees. Do not overfeed the bees.

9. Examine colonies during bright mornings when bees are busy; otherwise they might sting badly. When stung do not pull out the sting but scrape it off immediately. Rub some green leaf over the part stung to cover the smell.

10. Avoid all jerky and nervous movements while handling bees.

11. When bees are in a bad mood a few whiffs of smoke would quieten them.

12. Do not shift colonies from place to place frequently.

13. As the colony increases in strength provide additional egg laying space for the queen by giving foundation or old combs.

14. When brood chamber is full give super with combs.

15. During the heavy breeding season be on the look out for queen-cells and for the subsequent issue of swarms. Allow the prime swarm, if it issues early in the season and hive it as a separate colony. Do not allow any after swarms.

16. Build up the strength of the colonies prior to the honey season by swarm prevention, requeening, uniting weak stocks, provision of breeding facilities, etc.

17. Extract honey when 75 per cent of the cells are sealed and ripen the honey artificially. Do not extract the honey from the brood-chamber.

18. Beware of the wax-moth—the worst enemy of the honey bee. To control it keep the colonies strong. Remove all superfluous combs and give just enough for the bees. Examine the joints and interspaces of the hive body for eggmasses of the wax-moth. Scrape away the eggmasses and if necessary change the hive-body once in six days. Examine the combs and floor-board of the hive for caterpillars. Store the old combs in an air-tight and insect-proof receptacle. Examine them frequently and if infested by the worms dry them in the sun and eliminate the caterpillars.

19. The black ant is another serious enemy; treat the holes with Calcium cyanide. Provide ant pans or smear the legs with Tanglefoot.

20. The yellow banded wasp is also known to attack bees. Handnet the wasps. If possible destroy their nests.

Detailed information on the subject of bee-keeping is given in Bulletin No. 37 of the Madras Agricultural Department. For further information please apply to the Government Entomologist, Lawley Road P. O., Coimbatore.—*Hindu.*

SUGAR NOTES

The U. P. Government has revised the rate at which the Vacuum Factories will have to purchase cane. The new rate is annas five per maund (82 2/7 lbs.) of cane delivered at the purchasing centre, subject to the condition that the minimum will be increased or decreased by 0-0-3 for every 8 annas increase or decrease in the average price of Sugar above or below Rs. 8-8-0. Rules have also been framed to see that the cane which arrives in a factory during its temporary break-down is purchased by the factory.

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A thoughtful Indian suggested in the columns of one of the Indian paper some days ago that England should show preference to Indian

Sugar and that India as a part of the British Empire had a claim on the English Market and that the Government of India should commence negotiations towards the achievement of this. It is very unfortunate that according to the agreement of the International Sugar Council which met in London great restrictions have been put over India's exports of Sugar.

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Interesting details regarding the consumption of sugar in India and also the results of important research schemes were considered by the Sugar Committee of the Imperial Council of Agricultural Research which opened at Simla on 3rd May Sir Bryce Burt presiding. Eighteen members, representing the Central Provincial Governments and also sugar interests attended.

Twelve million tons of cane was consumed, mostly by chewing, while sugar factories use 11½ million tons for the manufacture of sugar and 43¾ million tons went into the manufacture of gur. An enormous quantity of cane was still left over and the Committee is understood to have expressed some concern at the alarming expansion of acreages of sugar production. The remedy considered by the Committee was to zone the cultivation of cane consistently with national economy and with the encouragement of cane-growing in the neighbourhood of consuming centres.

Among the research schemes which roused interest was one being carried on, in the Coimbatore station with the object of producing a type of sugarcane which could give more sugar yield per acre and at the same time withstand the effect of the Indian climate and the ravages of insect pests.

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The review of the quality of sugar manufactured in India during the season 1936-37, which was adopted by the Sugar Committee of the Imperial Council of Agricultural Research brought out several important facts in connection with Indian made sugars. It was observed that whilst there was a general improvement in the quality of sugar in respect of colour, the size of crystals remained practically the same, as the previous year. As compared with previous season, the production of inferior grade sugars had been considerably reduced, whilst that of sugars having superior colour had increased. Several Indian sugars compared very

favourably with Java White which is typical of the competing foreign sugars. The tendency of too many grades of sugar had undergone no change as the number of grades manufactured by factories this year was practically the same as in the last year.

* * * *

The question of affording protection to the Sugar industry during the period of seven years commencing from the 1st April next was discussed by the the Southern Indian Chamber of Commerce who have now addressed a communication to the Government of India and the Tariff Board suggesting the removal of the excise duty on sugar and the continuance of the effective protection to the industry to the extent of Rs. 7/4/- per cwt.

The committee expressed the view that the protection granted after the last Tariff Board Enquiry and the subsequent revenue surcharge has substantially helped the industry and resulted in an increase in the number of mills in the country, and of production and in a decline of imports. Mills had also been able to reduce the cost of production, build up reserve and develop financial strength. Improvements in these directions, the Chamber observes, would have been much more pronounced had the Government not come down on the infant industry with a heavy excise duty.

As regards the import duty to be levied during the next septennium, the Chamber states that the industry had yet much leeway to make and until the improvements necessary were effected, the industry could not be deemed to be out of danger. Further, with the largest area under sugar-cane cultivation in the world, India would soon reach the stage when it would have to export to foreign markets to keep the industry going and when that stage was reached, she could not successfully stand competition unless during this period of experimentation, the industry was enabl d to entrench itself strongly and build up its productive and financial strength. The Committee therefore urge that the Board would be well advised in recommending the continuance of effective protection to the industry to the extent of Rs. 7/4/- per cwt.

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"The present enquiry into sugar by the Tariff Board is essentially different from that of its predecessor in 1930. Then it was a question

whether an old industry, which was on the verge of collapse due to severe foreign competition, should in the national interests be granted protection," observed Sir T. Vijayaraghavachariar, Economic Advisor to Indian Sugar Mills Association, in an interview by the Hindu.

"Now the main issue is not," he said, "whether that protection should be continued, for protection for a period of 15 years (*i. e.*) up to 31st March 1946, is already assured by the terms of the Sugar Industry (Protection) Act. The point for determination is, if the rate of protection for the 2nd half of the period of 15 years should be the same as that statutorily fixed for the first half, or more, or less. In accordance with the policy of descrimination, protection formulated by the Legislative Assembly in 1923, the Tariff Board of 1930 had to be satisfied about the three conditions prescribed by the Indian Fiscal Commission, namely that there was an abundance of raw materials or a large home market for the finished product, that the industry could not progress temporarily without protection, and that ultimately, that is at the end of the period of protection, the indigenous industry could stand on its own legs, without further protection. In passing, I may remark how strange the last condition sounds in a world which is now dominated by the doctrine of economic nationalism. Any way, these conditions are not now under consideration.

Some Vital Problem.—"The Tariff Board of 1930 dealt with an industry which was small in size and which seemed to be on the brink of annihilation. There were then in India 29 sugar factories producing about 90,000 tons of sugar. Now sugar is the second largest industry of India (the first being the cotton textile industry). There are 145 factories which are estimated to produce in the current season over a million tons of sugar. In 1932, when the Sugar Protection Bill was on the legislative anvil, I was examined by the Select Committee of the Legislative Assembly. It must be remembered I was the applicant for protection then on behalf of the Imperial Council of Agricultural Research. One of the questions put to me was in what time I hoped to make India self-sufficient in the matter of sugar supply. I ventured the answer, "In the fifteen years of protection, I ask for." But Indian capital and enterprise both in the Agricultural and in the industrial spheres have outrun my expectations and on the faith of the protection assured by the Central Legislature, the country now produces all the sugar it consumes. About 16 crores of rupees, which were going out of the country annually as

price for the sugar it imported, now remain in India to the benefit of the Agriculturist, the manufacturer, the transport agencies, the merchant and of labour, both the manual worker and the brain worker.

"But the marvellous growth of the industry has produced a set of new problems. I do not refer to the question which vexes the mind of Finance Members, of the money lost in customs duties on imports, for that was inevitable and indeed foreseen. If protection was meant to be real and effective, the measure of its effectiveness was the measure of the loss of Government revenue. The problems I refer to are those of the alleged over production of cane by the Agriculturist, of alleged over production of sugar by the industrialist, and of the very real severe internal competition amongt producers behind the tariff wall leading to a fall in prices which threatens to go below the cost of production. There is also the very important question if Agricultural improvements in cane have kept pace with industrial improvements in the manufacture. There has been in the last five years a steady improvement in factory efficiency, manufacturing costs being steadily lowered but without a corresponding improvement in the cost of production of cane, the cost of production of sugar cannot be reduced to a level on which India can hope to compete on equal terms with Java. The cost of cane is the largest item in the bill for cost of production of sugar.—(*Hindu*)

The international sugar negotiations have successfully concluded by the signing of the agreement in London, providing for a scheme of export quotas, establishment of a permanent International Council to study questions relating to all aspects of the world sugar industry.

Of the 22 countries involved, the following are the principal basic tonnages permitted for exports :—

Holland and the Colonies	1,050,000	tons.
Cuba	940,000	"
British Colonies	965,000	"
Australia	406,000	"
Peru	330,000	"
Dominica	400,000	"
Soviets	230,000	"
South Africa	209,000	"

The United States will continue to import from the free market at least as much as at present.

India will prohibit sea-borne exports to places other than Burma, while Britain will limit domestic production to 618,000 tons.

The China Council (?) was empowered to vary quotas by uniform figure when necessary, provided the Governments concerned unanimously agreed to the change.

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The Committee of the Indian Sugar Mills Association have sent the following telegram to the Secretary to the Government of India, Commerce Department:—

"The Committee of the Indian Sugar Mills Association express their strong resentment against the reported agreement arrived at the International Sugar Conference to the effect that India has agreed to prohibit sea-borne exports of sugar except to Burma. The Indian Sugar Mills Association, on behalf of the industry, emphatically protests against any such commitment having been given and is surprised how such binding was agreed to and by whom, not only without consulting representatives of the industry whose interests are most affected by the reported decision, but also in the face of their insistent demand for a share in the export trade. The Committee regret the light-hearted manner in which the Government of India have been treating this important problem and should be glad to know whether such binding was given with the consent and knowledge of the Government. The Committee earnestly hope that the Government will issue an immediate statement repudiating this binding on India's legitimate right of export."

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SIR T. V. ACHARIAR'S CRITICISM

"The brief report telegraphed by *Reuter* does not give the grounds on which the Government of India agreed to the prohibition of Indian exports of sugar by sea except to Burma," Stated Sir T. Vijayaraghavachariar interviewed by The Hindu. In the present state of the industry very good reasons would have to be shown for such prohibition.

"It seems rather a pity," Sir T. Vijayaraghavachariar said, "that no non-official represented India at the World Sugar Conference to emphasise the Indian point of view before western countries, which, doubtless,

were too much absorbed in their own problems to bother about India." Some years ago, Sir T. Vijayaraghavachariar added, "the question of an export market for Indian sugar was an academic one, which has now ceased to be such. In a short time India will naturally be seeking markets across the seas apart from markets like Afghanistan beyond the land frontiers of India."

The Tariff Board have issued questionnaires on May 13 in connection with the enquiry as to the extent of protection required by the Indian Sugar Industry from March next year till march 1946.

There is a general questionnaire as already indicated in the Hindu dealing with matters on which the evidence not only of the manufactures of sugar, but also of importers, dealers, cane-growers and others interested in the industry is required by the Board.

A separate questionnaire has been issued for local Governments, for sugar refineries, for manufactures of sugar by the open pan system and Khandsaris, and for gur and jaggery merchants.

The latest date for replies is 25th of next month. The Board will then it is expected, study the evidence and decide on their programme of oral examination.

As at present arranged, the Board will stay at Ootacamand here until the first week of July. It is settled that they are to visit the Mandya sugar factory on Saturday, the 22nd instant.

Questions have been framed with a view to finding out how far the sugar industry had developed since protection was granted and what extent of protection is necessary for further development. Questions have been included for obtaining data as to efficiency in cane-growing and manufacture and all the necessary details regarding organisation, production, marketing and transport. The Board attach importance also to the disposal of by-products, molasses and begasse, and invite suggestions from manufacturers.

Besides asking for reasons for any rate which the witnesses may suggest for the remaining period of protection, the Board want to know the forms of assistance other than protective duty that may be considered necessary for the development of the industry.

"What has been the effect of the import duty on molasses, and has it adversely affected any industry in India?" is the last of 111 questions in the general list.—(*Hindu.*)

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Mr. Sarangadhar Das, Sugar expert, who returned from Simla after attending the meeting of the Sugar Committee of the Imperial Council of Agricultural Research, said, in the course of an interview, that the decision of the Sugar Committee to ask Provincial Governments not to extend sugar cultivation any further really meant that Bihar and U. P. were penalising the other Provinces.

The most suitable places for the growth of the crop were, he said, fully tropical Provinces like Orissa, Bengal, Madras and Bombay. The fertility of the area in these Provinces could best be judged from the fact that private enterprise in Deccan has been able to produce 90 to 100 tons per acre,—a thing so far believed to be impossible. In Behar and the U. P. both Governments and capitalists had encouraged cane cultivation during the last 6 or 7 years, the majority of sugar factories had been built up and a minimum price of 5 annas per maund of cane had been fixed and yet the industry, there, was not likely to be able to do without protection for a long time in the future. The extremes of heat and cold in those Provinces militated against the growth of higher quality and larger yielding canes.

The ideal solution for the present difficulties would therefore be the spreading of the industry over the various Provinces of India with a view to obtaining the best results in respect of both the quality and the quality of the cane produced, and with an eye on marketing facilities. With the the industry to spread out, the consumer would get his sugar much cheaper than at present, and the cultivator would be benefited in so far as he would have at hand a ready money crop to fall back upon in case of need. Also, his yield per acre would be larger.

Referring to the decisions of the Imperial Sugar Conference, Mr. Das said that he personally did not believe that India had come to a point where production of sugarcane, gur and sugar should be restricted. With increased efficiency of production and distribution, there should be a good chance for India to export the commodity at competitive prices. The Government of India at the London Sugar Conference should have seen

to it that India secured a reasonabla quota in the free sugar markets of the world.—(*Hindu.*)

The forecast made by the Director, Imperial Institute of Sugar Technology, India, Cawnpore is that the sugar production from cane during 1936-37 will be between 1,072,500 tons and 1,100,000 tons. The cane crushed will be 11,315,000 tons. Recovery Sugar per cent cane is 9,47. Out of a total of 150 factories in India during 1936-37 four did not work. The Provincial distribution of factories working with cane during 1936-37 is, United Provinces 71, Bihar and Orisso 36, Punjab 6, Madras 10, Bombay 6, Bengal 6, Burma 3, Indian States 8, Total 146. During 1935-36 only 137 factories worked.

The majority of factories commenced crushing between 15th of November and 14th December. It is estimated that, excepting one or two, the factories, will stop crushing on the 31st May.

The estimated duration of crushing season analysed from 111 factories which reported figures is shown below.

Number of days.		1936-37.
200 and over	...	...
175 to 199	..	2
150 to 174	..	20
125 to 149	...	51
100 to 124	...	10
75 to 99	..	3
50 to 74	...	3
25 to 40	...	1

The highest recovery of Sugar per cent cane is in Bombay (10.65) and the lowest in the Punjab (8.42).

Production of sugar in the Provinces as percentages of India's total is estimated as under :—

United Provinces		..	52.7	percent.
Bihar & Orissa		...	29.8	„
States	...	...	6.6	„
Bombay	...	...	3.5	„
Bengal	...	...	2.3	„
Madras	...	...	2.1	„
Burma	...	...	1.6	„
Punjab	...	...	1.3	„

(*Indian Trade Journal.*)

CHOLAM OR JOWAR MALT

Laboratory experiments have shown that foods of a great variety and a high solubility can be made out of Cholam malt, but in this note the preparation of a simple kind, malt food from cholam is, outlined. This can be tried in every home.

Cholam is soaked for a day in pure drinking water which has to be changed at least four times to allow proper aeration of the seed. The grain is allowed to sprout in a room for three to four days until the rootlets are about ¾" long. After drying in the sun, the husk and sprouts are carefully removed by pounding in a wooden mortar. The husked, unbroken grain is gently roasted in a roaster or frying pan till a characterstic aroma is given out. This treated grain is called malt which can be crushed and sieved to get fine flour. The coarse fraction can be crushed once again to get second grade malt flour.

Conjee prepared out of the cholam malt flour with milk and sugar added to taste, would make a beverage which has practically all the beneficial effects of any other malt. During the sprouting of cholam active substances like diastase are developed, which digest starch into malt-sugar and break down partly the protein and fat. The result is the formation of easily digestible material useful for infants and invalids whose digestive powers are weak.—(*Hindu.*)

THE INDIAN VILLAGE—ITS PAST, PRESENT AND FUTURE.*

BY RAO BAHADUR T. S. VENKATRAMAN, B.A., I.A.S., P.N.I.

Introduction.—I take it no apology is needed in these days for talking about any aspect of 'village and village life'. The city and the town which were holding a complete thraldom over the public mind all these years are losing their glamour somewhat in spite of their admittedly alluring attractions; and the 'village' would appear to be getting increasing recognition, particularly in our country and in recent times.

I propose to speak to you to night under the caption "The Indian village—Its past, present and future." You might perhaps question my claim to speak on this subject as all my official life and thought for the last quarter of a century has been linked up almost entirely with sugarcane. But this work has often taken me to the countryside in various

* Presidential address delivered at the Science Conference Hyderabad 1937.

parts of India and my contact with the Indian village has been fairly intimate. While at my special work I had perforce to witness the pleasure and tragedies of the villager and watch the changes that are steadily coming over the village. Secondly most of us—in this agricultural land of ours—have come from village life either directly or through our kith and kin.

One easily noticed change, in the village, is the migration of the villagers to the town. The richer of the villagers show a tendency to shift themselves to the nearest town or city for education of their children, for better medical help or for the characteristic amenities associated with urban life. Secondly, the more intellectual of the younger generation, who first migrate to the towns for their studies or to seek employment, do not generally return to the village, but settle in some town which they find more congenial for the full scope of their talents. If they do pay a visit to the village it is either to see an old relative who is too conservative to move to the town or in connection with some matter which renders their presence in the village unavoidable. Such visits are made of as short duration as possible and they get back to the town with almost a sense of relief.

Position of India with reference to Space and Time.—But before getting into the subject proper it is necessary to record here a few general observations on the position of our country with regard to both space and time viewpoints. With China, Japan and the South-Eastern Islands, India is situated in a comparatively densely populated area of the globe—about half the population of the world being crowded into a tenth of the Earth's land region. This has had its effects on the type of agriculture practised in the country, the selection of crops for cultivation and the life of the people as a whole.

Secondly, along again with China, India possesses a civilization and culture which was at least contemporaneous with, if not ancient to the civilization of Egypt, Mesopotamia, Greece and Rome. After making considerable progress this civilzation has however remained in a more or less quiescent and petrified state in our villages for well nigh two to three thousand years, little influenced by the great progress made by the West during the latter part of the same period. It is only within comparatively recent times that the Western civilization has come to spread into and influence the countryside. In more senses than one the Indian town represents the dynamic West with all the vigour of youth and the

village the comparatively quiescent East. Certain of the problems of the village to be discussed hereafter will be found traceable to the inevitable contact between the two.

Aryan colonization of India and Types of Villages.—The Aryans, who entered the country through the North-West route, first occupied the Indus valley and the Punjab plains and later spread to the coast of the Jumna as far as the Saraswathi. Subsequently they spread into Bengal and from there would appear to have sent out expeditions by sea to Burma, Ceylon and Java. The Vindhya ranges and the Aravalli hills long acted as an effective barrier against large movements Southwards into the Deccan and South India. The country to the South of these ranges remained for long Dravidian, though increasingly influenced by Aryan culture from the North.

The Ryotwari Villages.—The new Aryan colonists naturally found plenty of land to settle in and the obvious advantages of group formation brought into being two main types of villages. One was the type similar to what is now termed 'ryotwari' where each family or group of persons took up as much land as they could cultivate depending on the number of cattle and able bodied men in the unit. Site for the village was chosen at some convenient spot such as the banks of a river or canal or proximity to other source of water-supply. The persons constituting the village chose a head man who exercised all powers on behalf of the whole community. This type of village was generally associated with peaceful conditions.

Joint Village.—The other type called 'Joint Village' by Baden Powell was founded by powerful families or clans not necessarily agriculturists. The government of such villages was by the well-known Panchayat system and occasionally a group of such villages belonged to the same clan or owed some kind of allegiance to the same warrior chieftain in return for the protection they enjoyed at his hands. In these villages the cultivating classes were sometimes in the position of tenants. 'Ryotwari' villages sometimes got converted into 'Joint Villages' through conquest by some warrior chieftain.

The great change in the Village.—To realize fully the present conditions of the Indian village and understand its problems it is necessary to briefly notice here the changes that are coming over it and the reasons for that change. The Indian village of ancient times was practically a self-

government unit, having but little contact with the outside world. It grew all the crops required to meet all its simple needs and the surplus of good years was stored in the village granaries as a provision against future unfavourable seasons. The people of the village lived like the members of a big family under the accepted leadership of the village elders, the Panchayatdars. Land was plenty, needs few, and there was a great deal of contentment. The villager's outlook and knowledge were limited, rarely extending beyond the confines of his own village, and the villager's life ran an even course from day to day. This had been the condition for well nigh two to three thousand years.

One very important result of the contact with the West has been the development of the export and import trades which have affected profoundly the kind of crops grown and both the occupation and mode of life of the villager. It is steadily dragging him out of his isolation and throwing him into the world courrents of commerce and industry. He is not content to grow crops to meet the needs of his own village but finds it more 'profitable' to grow what are termed 'commercial' crops for outside markets as distant as New York or London. This has upset the old time food centred economics of the village and rendering them increasingly money centred. The more enterprising and intelligent of the villagers are attracted by the commercial life and tend to shift themselves to the nearest town or city temporarily in the beginning but often permanently in the end. It is no wonder that such great changes have brought in their train a variety of problems connected with our villages.

The Present-Day Village, Village Agriculture.—As agriculture is the sole occupation of the villager its present condition and its effect on the economics and life of the villager are well worth consideration. One outstanding feature connected with Indian agriculture is its great dependence on the monsoons. In spite of the great irrigation works—some of them the largest in the world—and the steady advance in the matter of tapping underground water, it has been estimated that seven-eigths of our agriculture is yet dependent on the monsoons.

Secondly, the villager is so little in touch with world markets wherein the results of his labours are evaluated and sold, that a large portion of his profits is intercepted by the intermediate agencies that market his produce.

Thirdly, land available for crop growing has not increased to the

same extent as increase in population. True some new lands have been brought under the plough and yields from existing lands have increased somewhat, but such increase is much less than the increase in population.

Fourthly, possibility of large augmentation in acre prouduction is severely handicapped by a variety of causes such as sub-division and fragmentation of holdings and the prevalence of rigid social customs and religious sentiments which cause the waste of such valuable manures as night soil and cattle dung and adversely affect the business aspect of agricultural production. Both sub-division and fragmentation are interrelated to each other and result from the same cause, viz, the mode of inheritance of landed properties as obtaining in both the Islamic and Hindu laws.

Village Cattle.—The Aryan settlers loved their cattle and valued them highly. A grazing waste round each has been the standard feature of the Indian village. Unlike China and Japan where the consumption of milk as food is considered a disgusting habit, this article has been highly valued in our land, and extensively used as food from ancient days. This is fortunate for a country like ours which otherwise is largely vegetarian. Milk was not banned even in the case of the semi recluse who was denied most other articles of diet. In the Brahmanical period the daily prayer included an invocation for the health and prosperity of the cow.

The cattle represents sometimes the heaviest capital outlay of the cultivator next only to land and he loves them almost to a fault.

But this very attachment and religious regard to the cattle—particularly the cow—is now working to their disavantage. India is unique in possessing an enormous amount of cattle without making profit from its slaughter. The old and the weak are allowed to deplete the fodder stock of the village with the result that the fitter and hence the more useful ones do not get their due share. Cattle maintenance is not looked upon as a business proposition and the sentiment towards them is similar to that of a rider to the old horse which had served him well when he was fit and strong, or of the lady aristocrat to her pet dog or cat in the West. The sentiment is too deep-seated for a rapid change.

The Motor, the Oil Engine and Electricity are steadily replacing cattle power (largely of the male sex) for transport and water lifting. On

the other hand, the demand for milk products is likely to increase in the future and it is desirable it should be so. Fewer but better type of cattle and tended with greater knowledge of their needs, are indicated in the future. Castration in as painless a manner as possible to work out the uneconomic types from the village stock is the crying need of the country-side. The world is getting accustomed to such ideas even in the human species. With increasing knowledge of factors determining the sex of the fertilizered egg will science be able to increase the number of heifers as perhaps in the future we might need more cows and less bullocks ?

Village Labour.—For agricultural labour the Aryan colonists would appear to have employed largely the local people—the Dravidians and Aborigines. The Indian labour is low both in wages and efficiency, certain extremist opinion equating a week's labour of the Indian to a day's of the Westerner.

But the demands of agriculture are such that, whereas at certain periods a large force of labour is needed, there is no demand during other parts of the year. This is particularly the case where the bulk of the area in the village is under the same crop. In the absence of work and hence wages all the year round, the labour migrate to other places with the result that, at the time of peak demand (as during paddy transplantation) there is labour scarcity. Crops like the sugarcane which need labour all the year round, greater diversity of crops or subsidiary occupations are needed for stabilizing the labour demand.

The Villager (and His Indebtedness).—Having briefly considered certain important aspects of village life, we are now in a position to consider the present condition of the villager himself. Though till recently but little affected by the changes around him, on account of his isolation, both mental and physical, he is being made increasingly aware of the changes around by the extension into the village of such symbols of modern life as the Post and Telegraph, the Bicycle and the Motor bus. Frequently also the village is visited by townsmen who is only too egar to demonstrate before the awe-struck villager eleganees and conveniences of urban life.

Economically he finds himself in a very disadvantagous position owing to his steadily diminishing agricultural income in contrast with increasing expenditure due to changes in living even in his own house-hold. Innovations in dress and habits and new wants like tea and coffee

are steadily forcing up family expenses. While the community life of interdependence has ceased to exist, the medieval social structure like the joint family system still persists rendering the villager's life unbalanced.

Dependant as he is solely on agriculture, the need for money always exists. This is true of the agriculturist all the world over and result from the fact that, whereas agricultural income comes in only at particular times like harvest, his expenditure is of a monthly if not of a daily nature. Extra profits from an exceptionally good year are more often wasted in urbanising his surroundings than being put by as reserve against lean years. The heavy indebtedness of the Indian villagers is well-known and has attracted the attention of all that have cared to study the village.

The villagers' debts are also often unavoidable. It has been calculated that nearly 90 per cent. of a villager's expenditure is on such essentials as food, clothing, rent and taxes, thus leaving but little margin for unexpected reverses such as crop failures or floods or sudden cattle mortality. Expenses on marriages and funerals, which to the villager are equally unavoidable because of his traditional ideas, are other sudden items of expenditure. The margin of extra income is so narrow that the loss of a buffallo or the long illness of the working member in the family is known to drop the villager down in the social scale sometimes never to recover his original position. The only security he can offer against such debts is the land, his only possession in this world, and once pledged he finds it difficult to redeem it.

While on the subject of the economics of the villager it will be appropriate to consider here the various types of waste that are taking place in the village. Foremost, perhaps, is the agricultural waste resulting from the uneconomic subdivision and fragmentation of land which precludes its cultivation to maximum benefit. Then comes the waste of cattle and human labour due to fragmentation, the drain of village money by way of interest on loans raised by the villagers and loss of valuable manures like human and cattle voids. Cattle manure is wasted as it is needed for fuel. It is such a suitable fuel in the Indian household that a substitute alone will be operative in bringing about its rapid discontinuance as fuel. Human voids instead of being utilized as in China and Japan, are allowed to render the streets and surroundings unsanitary and poison the clean country air. There is considerable waste of both energy and material resources through adherence to sentiments and habits which, perhaps useful in olden times, are useless and wasteful under the changed conditions of to-day.

One important waste which has to my mind far-reaching results is that caused through forced idleness. This is because agriculture, which is often the sole occuption, is not able to keep the villager busy all the year round. This forced idleness is very harmful, changes his whole outlook on life and lowers his character in many ways. No tonic is so good as healthy and steady work all through the year and this is denied to the average villager. The comparative prosperity of villages located near towns or industrial centres proves the advantages of employment all through the year.

The Exodus from the Village.—The most serious of the unfavourable changes coming over our villages is the steadily increasing exodus of people from the village to the town. There is little doubt that the villages were comparatively more populous in the olden days. One main reason for this exodus is the growing inadequacy of agricultural income not supplemented by income from other sources. A second reason is the shifting of the main activities of life to the town. Educational facilities and other urban conveniences are increasingly attracting the villagers to the town. Dr. Mann was struck by the significant absence from a Bombay village of youths between the ages of 14 and 20; and this is largely true of other Provinces as well. They had gone out for education or to seek employment.

A part from the number, the quality of human material contained in the exodus constitutes, a serious drain. Take for instance a family of four sons all of whom had gone to the nearest town for education. The successful ones get employed away from their villages in due course and rarely return to it except if at all in old age. The unsuccessful ones, on the other hand, with nothing else to do perforce return to the village and settle there, thus increasing the pressure on the land often disproportionately to their contribution to the village assets. Secondly, the richer landlords who, by their superior resources, could, if they cared, undertake experiments or launch fresh agricultural ventures, are attracted to the town and leave behind in the village their less resourceful brethren. Similarly, the capable artisan leaves for the town to make the most of his talents. Culture is now town-centred and there is little scope in the village for the full development or unfolding of one's talents. In the olden days when the village was practically autonomous and had its own funds to cater to the needs and amenities of the village the opportunities in the village were greater; and it was possible to retain in the village at least a portion of the intelligentsia, though even then the best of talents resorted to the capitals or courts of Kings for patronage.

The Future of the Indian Village.—After this rapid review of the Indian village in the past and the changes that have been coming over it up to the present time we are now in a position to consider its future. There is little doubt that the general tendency so far has been for the village to steadily go down in prosperity and importance in contrast to the town which has increasingly drawn the best from the village. The question to consider is, if this is in the best interests of our country and, if not, are any steps needed to place the village in a better position than now. Does the future lie in a greater and further development of urban life, evolving measures that would somewhat mitigate the inevitable disadvantages associated with it or does the situation need radical changes in the village and village life, imparting into it certain characteristics of the town ?

In spite of its having become trite, the statemnet that ours is an agricultural country warrants repetition on account of its far-reaching effects on all our activities. The plough with a pair of oxen is perhaps the one symbol that would properly represent India as a whole with its different classes and communities. Secondly, the rapid increase of population in our country and China has become a byword and this renders incumbent a further increase of agricultural production. Science has so far not succeeded in growing crops on the roofs of houses or on road sides in towns and the best achievements of agriculture have been in the country side. The clearly indicated lines of advance for the future, therefore, lines in improving rural conditions and rendering our villages better and more efficient in the discharge of duties set to them by the country as a whole, viz., (1) the proper and adequate feeding of the steadily increasing population and (2) rearing a healthy stock of men and cattle and maintaining them in a fit condition.

Both town and village are needed for the full and complete development of our country as a whole. The town is a natural and inevitable product in this development. 'If God made the country' the town was and is being made by man, His agent, and in response to forces no less natural in the broad sense of the term. Ours has been and still largely is a land of villages but the towns have risen up and are bound to multiply and expand in the future. In recent times there has been a growing tendency to centralize culture and activities in the town to the disadvantage of the village; and the towns and cities have in a sense grown at the expense of the village.

But each has certain specific advantages and inevitable defects. In crop growing when one comes across two types both of which possess desirable characters, the crop servant-called the Breeder-tries to raise hybrids between them for producing kinds which might combine in themselves the good points of both and eliminating as far as possible the defects of either. This process of hybridization is neither new nor recent. Nature has been doing this since the beginning of life and the existing crop types are the result of such so-called 'natural' hybridization and selection. A similar procedure is indicated between the town and the village and such a process is already in progress. The open air extensions that have grown round towns in recent years with compound houses and gardens-indicate the attempt to ruralize the town in the matter of health and surroundings, while the Post Office, the rural dispensary, the school, and even the bus horning its way through the village are in the nature of urbanizing the countryside. Suburban colonies also represent such an endeavour to combine the advantages of both country and town life. While the process is already in action it is desirable to speed it up by conscious endeavour.

Improving agricultural efficiency.—Elsewhere we have considered certain serious handicaps the present-day village agriculture is labouring under. Thanks to the good work inaugurated by Lord Curzon's Government about thirty years ago reinforced and supplemented by the elaborate and far-reaching recommendations of the Royal Commission on Agriculture of 1930, we are now in a position to feel that technical advances in agricultural and allied sciences can be taken to have been provided for. The Imperial Council of Agricultural Research, a lusty child of the Royal Commission, has already won back to us a major industry and is engaged in grappling with problems of fundamental importance like marketing.

While on this point I cannot resist the temptation to refer to the outstanding achievements in the breeding of valuable crop types. Our most rapid and effective advance in agriculture has been along this line and to-day almost every crop is being systematically bred all over the country. Advance in this direction-viz., the improvement of crop type and distribution of its seed has been the most suitable to our present conditions of comparative property of resources in other directions. For the production of these types the resources in the way of plant material of more than one country has been and is being systematically employed. Combined with substantial Tariff protection afforded by a kind Government, it has resuscitated our sugar industry and thus saved a drain to the

country of 15 crores of rupees per annum on the average. It is employing a hundred thousand additional labourers in the factories and about 1,500 graduates in these days of unemployment besides the five million extra agriculturists directly benefiting from it. This demonstrates the great value to the country as a whole of industries founded upon our own agricultural products.

That it is possible to augment the agricultural income of the villages to a considerable extent is evident from the fact that even in the West, which is much more advanced in this matter, the opinion is held that further marked advances are possible. A recent theoritical calculation has shown that, under the best of conditions and with the needed machinery and organization, twelve able-bodied men are sufficient to cultivate 365 acres of sugarcane and from it supply the carbohydrate needs of as many as 14,500 men and that thirty five individuals could be fed from the produce of one acre, if properly handled. It is true that these calculations are somewhat theoretical as they assume conditions which do not exist and which it may be difficult to fully materialise, yet they are useful indicators of possibilities in the direction.

The evils resulting from sub-division and fragmentation of holdings have already been noticed. These are beyond the capacities of technical departments to remedy, however earnest or well organized they may be. They are caused by ideas and sentiments deep-seated in peoples' minds and legislation is the only remedy. It is a matter where we have to help ourselves and submit to certain hardships in the interests of the country as a whole. Other countries have shown the way. In Austria the economic holding is recognized by the law of the country and is both indivisible and unmortgageable (except for short periods). In Italy such holdings are said to be inalienable, indivisible and unseizable. In Denmark a law passed in 1837 provides for the proprietor leaving his farm intact to any one of his children and providing moderate consideration for his other heirs. It is gratifying that certain provinces have initiated action in this direction.

THE HUMAN ELEMENT

Literacy and education.—As the efficiency of any programme of rural improvement depends primarily on the Chief Agent in it, the Villager, it is important to consider means for increasing his efficiency. If we compare the Villager with Townsman one point in which the latter

often scores over the villager is his literacy if not always his education. This is not the place nor is it necessary to detail the various advantages of education or even literacy. Suffice it to say that even in elementary education we have a very effective weapon for bringing the villager out of his narrow horizon, breaking down his superstitions, placing him in touch with the rest of the world through the printed word and for facilitating the introduction of various reforms for his betterment. In the progressive evolution of the human species acquisition of certain characters such as the 'erect habit' are credited with having introduced far-reaching effects. Education belongs to this category.

Though it is true that the village teacher did exist in the olden days and at least certain classes of the population received some kind of school and even higher education and though there is evidence that reputed universities did occasionally flourish in certain rural parts, regular schooling and education were not considered essential.

Education given in the village school should obviously possess the rural and agricultural outlook and be vitally linked with the every-day life of the village. In our boyhood days we learnt more about the geography and history of places we could never hope to see while being comparatively ignorant of our own district and its environment. Such an important subject as the anatomy and physiology of the human body was reserved till the student had mastered the various distinguishing characteristics of the metals and the non-metals or the names of the then two important towns in the Sahara region. There is now a steady and welcome change in this matter. Nature-study lessons fit in well the agricultural life of the villager and I have often wondered why the village vacations should be timed to the conveniences of metropolitan examinations rather than to the busiest agricultural seasons in the village when the boys could perhaps help their parents in the field and gain first-hand knowledge of subjects taught in the school-room.

Intellectual alertness.—A second characteristic of the Villager as contrasted with the Townsman is often the slower moving intellect of the former. This is not mentioned here in a derogatory spirit; the difference is due to difference in the environment. The every-day struggle with the great forces of nature develops a deeper character in the villager, but in intellectual alertness he is often inferior to the townsman. Agricultural operations are generally spread on the broad land and hence the workers are in comparative isolation, whereas intellectual alertness is greatly

accelerated through contact and clash with other minds a feature of industrial life. The rather extreme opinion has been held that most agricultural improvements themselves have been from men whose intellects have been sharpened by industries and commerce. The linking up of villages with towns and other villages, through better communication facilities, for instance, will remedy the situation.

Business habits.—Yet another common defect of the villager is the lack of so called 'business' habits and 'business' mentality. This again is due to his environment and tradition. Nature's processes with which the Village Agriculturist is primarily concerned do not generally need the punctuality of man of business or commerce. The cow is insured both in Demark and Switzerland on account of its importance in rural economies. The absence of insurance measures in our villages against crop failures and cattle epidemics, which are by no means uncommon, is largely attributable to the absence of education and business outlook. The villager's income would be both enhanced and rendered steadier by the import of the 'Business' mentality into his activities such as agriculture and cattle maintenance.

Outlook on life.—The villager's outlook on the world is often narrow because of the isolation and the absence of literacy. Whether he likes it or not, the Villager is being dragged into the world currents of commerce and industry and his horizon needs to be broadened by education. His constant fight with forces of Nature over which he has little control, tinges his ideas with almost fatalism. A bad season too often disproves to him the truth in the saying 'As you sow so you reap'. Industrial activities, on the other hand, are associated with processes which demonstrate the control of natural forces by man and this has a tendency to develop in him certain amount of self-confidence, if not of human pride.

Cottage Industries.—In this study of the Indian village life, we have frequently noticed the need and advantages of industrializing the village. We have found that industries are desirable in the village to find employment for the people all through the year, to stabilize labour, to tone up the villager in various directions and to supplement and steady his income. The large-scale industries, which have developed in the country-while both useful and important for the progress of the country as a whole—have helped the villager but little. On the other hand, they have adversely affected the village tending to draw labour and brains away from the village. What is needed is the establishment of cottage industries in the village itself so as to improve the conditions for living in it.

It is obvious that the closer such industries are linked up with agriculture and agricultural products the better they would fit in with village economics. Cattle being an important adjunct of agriculture, industries like cattle breeding and production of milk and milk products at once suggest themselves. The value of cattle for agriculture is not confined merely to its use as labour, but the trend of recent work is indicative of their playing a very important part as the store house of the right type of manure for crops. The animal and plant kingdoms would appear to be the counterparts of one unit, each benefiting from the waste products of the other. Bee-keeping, the poultry industry, fruit growing and canning and preparation of tinned and infant foods for the benefit of the townsman would fit in well into the village.

Other suitable industries would be the partial preparation of manufactured products in the village itself as a rural industry. Cotton ginneries, seed decorticators and oil presses belong to this group. It saves in the transport of raw material to the central factory, the half-prepared material being generally less bulky than the original raw product. The retransport to the village of the bye-product of manufacture such as seeds in the case of cotton which are needed back in the village both for sowing and as cattle food is also avoided. Minor industries connected with products or articles available in the village or vicinity, such as cocoanut industry in the West Coast and fish curing in seashore village, help to keep the villager prosperous.

Other handicrafts and domestic industries where the needed material is imported from outside and worked in the village during the off-seasons, include weaving, dyeing and the manufacture of toys and trinkets. In spite of technical advances there are yet certain industries which lend themselves to be worked in the villages as domestic industries. The manufacture of toys in the Black Forest regions of Germany, watches in Switzerland, cutlery in Sheffield and little fans, flower baskets and ornamental pieces in Japan are of this class and are a great help in supplementing and steadying the villager's income. The mechanical efficiency obtained in the village as the result of such rural industries gives the village a 'mistry' class of who should prove increasingly useful in the repairs and upkeep of farm machinery and water lifting pumps which are spreading in the country.

Co-operative Organization.—The value of organizing on a large scale for increasing efficiency is well known and widely accepted. Most village

activities on the other hand, have by their very nature to be on the small scale and their being grouped together through co-operative organizations is the only remedy. Through them even the small farmer and producer is enabled to command facilities and advantages generally available only to large-scale units. The purchase and sale of articles connected with cottage industries, for instance, need grouping together through co-operative organizations for best results.

Amenities of Life.—As a class our villages lack the convenience and amenities of urban life. While perhaps certain of these might be considered unnecessary and a few even harmful, there can be no doubt that the bulk of them are in tune with and are necessary for modern progress which is taking hold of the world whether we like it or not. Convenience like means for rapid transport, the Post and Telegraph, the newspaper and the ever-increasing improvements associated with the development of electricity are major blessings which it is desirable should be extended to the villages as quickly and as completely as possible. It is the absence of these in our countryside that is partly responsible for prevailing distaste to village life. The village is easily healthier than the town in such important factors as pure air and open spaces and if only certain urban facilities are implanted in the village, its attractions for settlement should prove irresistable.

For permanent results the urge for rural improvement should be implanted in the village itself. This could be achieved only by improving the chief natural agent in such work-viz., the Villager—and making it attractive for him to live and have his being in the village itself. Endeavours that are town centred and taken to the village for temporary periods, for lectures, demonstrations or shows however honest or energetic-have an outside flavour to the villager and do not, therefore, get permanently assimilated into village life.

Conclusion.—To sum up, there is little doubt that the villages of old were more populated than they are to-day largely because of conditions prevalent at the time. Those conditions will never return however much or sincerely we may hanker after them. The town and the characteristics associated with urban life are definite products in the march of events and need to be accepted as such. Though there are drawbacks associated with urban life the town has its own good points which need extension into the village to keep rural life in tune with the changes around us. At the same time, the countryside has advantages like

open spaces and absence of congestion which can never be reproduced in the town.

Life activities that were village centred in the past are increasingly getting town centred to the disadvantage of the former. In the interests of the country as a whole relationship of mutual help needs to be established between the two. The town should extend to the village its greater knowledge, quicker living and the manifold amentities of the modern age. Contribution from the countryside are of equal importance. It alone can produce the raw materials of commerce and industry and thus help in the growth of towns and cities. It alone can supply adequately and wholesome food to the millions of our land whether resident in the village or town. Lastly, the countryside alone can imbue the urban 'business' civilization with the deeper character and larger humanities which are nurtured in the villager through his more direct and constant contact with the great forces of Nature and of life. Our duty then is clear: Namely, to improve the Village, the nucleus of our country life and infect its Chief Agent, the Villager, with a chosen culture of the virus of modern age through Education and Industrialization.

ARTIFICIAL AIDING OF PLANT GROWTH

Irradiation with Neon Light.—After years of experiments in Holland and elsewhere, an appreciable measure of success has recently been achieved in promoting the development of plants by irradiation with artificial light, J. W. M. Roodenburgand and G. Zecher, in a paper in *Philips Technical Review* (Eindhoven) of July last describe recent technical developments, and show that it is now possible for the market gardener and the amateur horticulturist to employ irradiation on a practical scale.

The growth of plants is naturally intimately connected with their photosynthesis. As photosynthesis is most active in red light, it is necessary to use red rays. Twenty years ago neon light was suggested but this light is not so easy to manipulate as glow lamp light, so further experiments were made with glow lamps. These showed that although the development of leaves was promoted, the general quality of the plants suffered, as the stems and stalks grow too 'leggy.' Experiments have now shown that provided the proper 'dosage' is given, neon light is exceptionally suitable for plant irradiation. The stems become thicker, the roots are stronger and frequently the formation of blooms and fruit is much promoted.

When neon lights were introduced for the irradiation of plants, they had already been employed for several years as luminous advertisements. For these purposes long glass tubes are used, into the ends of which two iron electrodes are fused. The tubes contain a neon filling at a pressure of approximately 10 mm. They are run at a pressure of 3,000 volts and emit a comparatively small luminous flux per metre of tube length. For use in damp forcing houses for the irradiation of plants, these tubes would be objectionable owing to the risk of shock; moreover, their low brightness makes it difficult to obtain the best illumination. To get a satisfactory illumination, it was necessary to reduce the pressure to 1 mm. or less. But at this pressure the iron electrodes disintegrated rapidly so that the life of a tube was only a few hours. A solution was obtained by using hot cathodes similar to those used in gas-discharge tubes for highway lighting. This enables the tubes to be run at low pressures.

The hot cathode tubes are connected directly to 220 volts main supply, through series-connected 'choke' coil. A simple device is employed for starting up the tube, since the running voltage is too low to initiate the first electric discharge through the low pressure neon gas. During the burning of the lamp, the cathode suffers practically no disintegration and the light output remains uniform. After 2,000 hours, the cathode begins to be atomized and a black deposit forms on the glass walls. The tube should then be replaced. The tubes are short and mounted in reflectors which considerably increase the efficiency of the irradiation.

Photographs are given which show the effects produced by subjecting flowering plants and strawberry beds to irradiation for periods up to three months at eight hours per night in mid-winter. Compared with plants which have not been treated in this way, the forcing effect is very pronounced.—(*Nature.*)

INDIAN COFFEE

An important announcement made at the latest meeting of the Executive Sub-Committee of the Indian Coffee Cess Committee was the offer of help by the Imperial Council of Agricultural Research and the grant of £100 for conducting roasting and liquoring tests on samples drawn from consignments of Indian Coffee received in London. This piece of research will be undertaken under the direction of the Indian Coffee Market Expansion Board in London. The planters have received this news with the greatest satisfaction, for they have discovered that, so

far as the British market is concerned, quality alone counts in open competition between East Indian and other coffees. So long as there was no such competition, the Indian produce had no lack of admirers are drinkers, but things are quite different to-day. Unless it can show better properties than the coffee of East Africa, for example, its chances in the Mincing Lane are rather poor. The Market Expansion Board of the Indian Coffee Cess Committee, it is but fair to record, have lost no time in attending to this part of their duties. If, as a result of the investigation by the Imperial Council of Agricultural Research, the defects of Indian Coffee, whatever they may be, are found out and if measures for remedying them are possible the future of Indian coffee will be decidedly brighter. The Indian Coffee, that is to say, certain renowned marks of it do possess certain distinctive merits, but the Mincing Lane buyers seem to attach great importance to the liquoring qualities of the samples submitted for their inspection and if this virtue can be extended to other marks much will be gained or achieved. It is a fact which none can deny that certain marks of Indian coffee possess rare liquoring qualities, but their number is limited. Nothing is impossible to agricultural scientists and the defects of Indian coffee, whatever they might happen to be, should certainly be within their power to rectify. Science has done wonders, if not, miracles in the cultivation of fruits and flowers and it should be quite possible for the Imperial Council of Agricultural Research to suggest methods for improving the quality of Indian Coffee in general wherever there is room for doing so. In due course the soil of the prominent plantations may come in for a critical examination at the hands of the Council, and if it is found that it has been impoverished by long use it would be easier to suggest means to enrich the same by the application of suitable scientific fertilisers of which newer brands are put on the market from time to time.—(*Hindu.*)

NUTRITIVE VALUE OF MILLK

The British Government's Advisory Committee on Nutrition say, in the course of their report, that the consumption of a sufficient quantity of milk is the key to proper nutrition. "We have computed that the requirements are equivalent to an average allowance per head of the population of seven-eighths of a pint of liquid milk daily. The present national consumption of liquid milk is less than one-half of this amount. If condensed and dried milk is included the national consumption is still only 60 per cent of the amount suggested. We regard the deficiency with special concern and we find it necessary to refer to it repeatedly through-

out our report. The desirable amount of milk for children is from one to two pints per day, for expectant or nursing mothers about two pints per day, and for other adult members of the community half a pint of milk daily. Turning to other constituents of a balanced diet, the committee advocate an increased consumption of fruit and green vegetables and also of potatoes—the latter in substitution for some of sugar and highly milled cereals in ordinary diets. It also draws attention to the particular value of sea fish as a source of good protien and iodine and other minerals.—(*Hindu.*)

DESTRUCTION OF THE BED BUG

A promising advance in solving the problem of the destruction of bed bugs is reported in the *British Medical Journal* of February 27, p.459 by Messrs. S. A. Ashmore, of the Government Laboratory, and A. W. Mckenny Hughes, of the Natural History Museum, acting for the Committee of the Medical Research Council. Disadvantages attach to most of the treatments previously tried. Thus hydrocyanic acid in the gaseous form is lethal to the insects and also to their eggs, but the use of this highly toxic substance obviously requires great precautions, especially, for example, in treating a room situated in the midst of tenements. Certain chlorinated aromatic derivatives appeared promising, but were found to act as liver poisons on the animal organism, and presumably on man, if traces were left unevaporated.

The authors put forward a simpler method with which they have had promising results both in the laboratory and in about two hundred infested houses. It consists in spraying the room at a temperature not below 60 degrees F. with a quantity of fairly high boiling coal-tar naphtha for which a specification is given, the room being thereafter sealed for eighteen to twenty-four hours. It is claimed that this substance is not only lethal to the insects, but is also an ovicide, and that it is not harmful to other animals. The concentration of vapour necessary is well below that of the flash-point of its mixture with air. Research is going on at the Field Biological Station of the Imperial College of Science to determine which of the many constituents of the coal-tar naptha is specially efficacious, but the above-quoted report points to a remedy, which is cheap and easily obtained. It is greatly to be hoped that this method proves successful, for this social evil is a very great and widespread one.—(*Nature*)

AGRICULTURAL RESEARCH IN HYDERABAD

Experiments in Hyderabad.—Mr. Mahomed Abdul Majid, Acting Deputy Director of Agriculture, Western Telingana Division, broad casted recently from the Hyderabad State Broadcasting Station, a talk on "Farms and Experimental Work of the Department of Agriculture.' He said:

"On studying the crops grown by the ordinary cultivators, we find that a large number of them give produce of inferior quality. Improvements should be effected in the quality of the produce to enable the Indian farmer to successfully compete with that of other countries. This can only be done by research. The results of researches in other countries cannot be introduced into the country straightaway, because they may or may not prove economically useful for general adaptation here. It is essential that these results should carefully be tested on a field-scale for a number of years, before being actually recommended to the cultivator. Such field tests are carried out at Government Experimental Farms which have been established in different districts of the Dominions simultaneously with the development of the Agricultural Department.

The State Farms.—The Main Experimental Farm, Himayatsagar, is situated below the Himayatsagar dam. The soils are typical of the Telingana country. The farm is furnished with up-to-date laboratories and scientific equipments. The headquarters of the Deputy Director of Agriculture, Western Telingana, of the Economic Botanist, the Agricultural Chemist, the Horticulturist and the Entomologist are situated in this farm. The Experimental Farm at Sangareddy supplements some of the work done at Himayatsagar on Chalka soil, because it has a larger area of high lying, well drained, true red Chalka soil; and that at Rudrur, with soils, typical of the area commanded by the Nizamsagar Project lies in the Nizamabad District. The chief object of the Farm is to conduct experiments with a view to finding out the methods of utilising the large quantities of available water in raising "Money Crops" like sugarcane, wheat and cotton. A Main Experimental Farm is situated at Warangal. The main Experimental Farm at Parbhani forms an important station for the Mahratwada area. Since it contains black cotton soils of varying nature, ranging from medium to deep black, the problems here chiefly concern cotton, wheat and jowar, which are the most important crops of Mahratwada.

The soils of the Main Experimental Farm situated at Raichur are representative of the Karnatak tract. Here is also situated a "Dry Farming Research Station" which is partly financed by the Imperial Council of Agricultural Research. There are poultry and cattle breeding and dairy farms at Himayatsagar.

The results of the experimental work that is being carried out in these farms in accordance with a carefully conceived programme may be briefly summed up, manurial, rotational varietal, poultry.

Manure.—Manurial experiments are concerned with the serious shortage of manure that is felt in the raising of good crops. Different combinations of castor cake and sulphate of ammonia have been tried as manure for sugarcane at Rudrur. The indications are that 2,000 lbs. of castor cake and 124 lbs. of Sulphate of Ammonia is the most suitable combination. Castor cake has the additional advantage of acting as a deterrent to white ants, which some times cause irrepairable damage to the cane crop, particularly in the Telingana Chalka soils, In connection with rice, various artificial fertilizers like Nicifos, Sulphate of Ammonia, Super-Phosphate and Oil-cakes have been under trial at Himayatsagar. The results so far show that the plots treated with nitrogenous manures yield better than those treated with other manures, and castor cake competes very favourably with the nitrogenous artificials. It has been observed on the Parbhani Main Farm that green manuring with sunn hemp has resulted in better yields of wheat.

The rotational experiments are being made with the object of finding out one or more Rabi crops which could profitably replace the Tabi paddy. The Rabi crop would require less water than paddy. If more water is available it can be used to irrigate more area. In this experiment rice is grown in all the plots in the Abi season, but in the Tabi season some of them are put down under various Rabi crops instead of rice. Of the Rabi crops, garlic and onions seem to be the profitable varieties. The present practice with the cultivators of Chalka land in Telingana is to grow jowar and castor alternately. Experience at th Government Farms has shown that groundnut and Tur can successfully be grown on this kind of soil. It is considered that cultivation of th two crops should be encouraged so as to provide the cultivator some thing more to grow, by introducing them as rotation crops. of them are leguminous plants, and therefore are expected to add t fertility of the soil at the same time. Two different rotations have

designed, and are being tried at the Sangareddi Farm, viz, (1) Three year rotation, including groundnut, jowar and castor, and (2) four-year rotation including groundnut and jowar, tur and castor.

Varietal Experiments.—A large number of varieties are being tried at different experimental farms with a view to find out the most profitable ones. The local varieties of sugarcane not only lodge but also yield poor out turns. Varietal tests conducted at Himayatsagar, Rudrur, Warangal, Parbhani and Raichur, show that the Varieties Co. 213, Co. 290 and P. O. J. 2871 which are erect yield better. The cultivators have taken up the cultivation of these varieties on large scale. A similar experiment with different varieties of paddy has given two profitable varieties, viz., Paddy Himayatsagar No. 263 and Paddy Himayat-sagar No. 504. In cotton, two strains, Gaorani No. 4 and No. 6 have been giving higher yield and are at the same time superior in staple and ginning qualities. The Khariff cotton varietal tests in Chalka soils at Sangareddi show that cotton can be grown as unirrigated Kharif crop in the Chalka soils of Telingana with good out-turns. Of the varieties tried Gaorani No. 12 gave the highest yield.

Of the various breeds of fowls under trial, White Leg-horn and Rhode Island Red have proved useful and are becoming popular among the people.—(*Hindu.*)

GROWING CROPS WITHOUT SOIL

C. G. Plested '37

Can crops be grown without soil? In recent experiments, Dr. W. F. Gericke of the University if California has shown that exceptionally high yields of vegetables of more than average quality can be grown without the use of soil. He is at present co-operating with greenhouse men and truckgardeners in order to find the optimum conditions for growth of the various crops on a commercial scale. It is predicted that this method ill become quite widespread not only in the production of flowers and etables, but for use with such major farm crops, as corn, potatoes tobacco.

Under the system now in use the plants are grown in a tank or vat ning the chemical elements necessary for plant growth. A rack three inches deep with a wire screen on the bottom is placed in

contact with or just above the solution. Then several inches of excelsior or peat moss are placed on the screen. Although this material furnishes very little food to the plant, nevertheless it forms an excellent medium for plant growth. It not only holds the plants in place, but forms a loose, open medium where the roots can develop freely, as they extend downward into the nutrient solution where there is an abundant supply of plant foods.

In some greenhouse experiments the solution was heated to 85 degrees F., and under these conditions, tomatoes yielded 300 tons of fruit per acre over a period of 12 months. Nearly all the flowers bore fruit and the plants grew to a height of over 25 feet. "The potential yield of tomatoes from a unit area of properly prepared nutrient solution is manifold greater than that of soil, because of the greater density of stand, taller plants, bearing fruit the entire length of the stalks, and longer growing period."

During the past summer, 12 tanks were used for growing tomatoes at Del Monte Farms. Some plants were set in excelsior and others were grown in soil nearby. Those grown in the solution were taller and occupied only a fraction of the area of those grown in the vats. Up to Sept. 6, the yield of those plants in the vats was 841 pounds as compared with 315 taken from those in the soil. The fruit grown in the vats was much firmer in fleshing than those grown in soil and it packed more than three times as many tins solid pack as the same poundage of soil-grown tomatoes.

"Production records of potatoes show a yield at the rate of 2500 bushels per acre; onions, 60 tons per acre; and corn. 300-500 bushels per acre, Large yields have been received from such crops as turnips, beets, carrots and celery," states a recent report.

According to Dr. Gericke, it will be possible to increase crop yields per unit area from ten to one hundred fold by the above method. As this method of growing crops develops commercially, it will surely find application in our large cities and densely populated areas. Even in Canada, it should be useful in producing greenhouse crops more cheaply and more abundantly.

The above material is taken chiefly from an article in the C. R. E. A. News Letter, December 10, 1936, to which organisation we are also indebted for the loan of the cuts.—(*Abstract O. A. C.*)

NEED FOR A SOIL SURVEY OF INDIA.

A discussion on the need for a Soil Survey of India was held during the Indian Science Congress Week at Hyderabad (January 1937) Rao Bahadur B. Viswanath presiding.

In introducing the subject the President stated that the answer to such a general proposition as "the need for a Soil Survey" would undoubtedly be in the affirmative; but the point for consideration was about the type of Survey. In arriving at an answer to this question, it would be necessary (1) to consider the object of a soil survey, (2) ascertain what had already been done in India and what was being done and, (3) to define what was wanted. A soil survey could be carried out for one or more of many purposes. For example, it could be carried out for settling new land. It could be carried out for ascertaining the physical and chemical characteristics of the soil with reference to manurial treatment, and irrigation projects. In regard to the first point there were 150 million acres of cultivable waste land. All this land was, however, not situated in one compact block but was scattered in small patches all over India. It was necessary, therefore, in the first instance to ascertain the nature and the disposition of the waste land. This would perhaps form a subject of enquiry by the Departments in the Provinces. During the past Quarter of a Century soil surveys were in progress in different parts of the country to ascertain the manurial and fertiliser requirements of the soils. As a result, a considerable amount of valuable data were obtained and these were being used in advising on manurial programmes and fertility projects. In recent years, enquiries had been commenced in connection with irrigation and drainage problems with a view to ascertain the most suitable alignment for irrigation and drainage channels. There remained, therefore, the survey for the classification of soils so that the information obtained would be useful in interpreting the response to manurial treatments and for research and advisory work. They had, therefore, to consider carefully what methods of survey were needed for this purpose.

In England the basis of classification in the early days was geological, the assumption being that each geological variation gave rise to its own type of soil. Subsequently this was not found to answer the purpose, as the effect of climate altitude, topography and other factors was considerable, so that soil formed from the same geological parent

material varied considerably. Then there was the Russian and American methods of classification which were chiefly based on the study of the soil profile.

The soils of India could be very broadly classified into the Indo-Gangetic alluvium covering about 300,000 sq. miles; the tract of black soils covering a total area of about 200,000sq. miles, and a red soil tract including laterite soils of 150,000 sq. miles. The black soils although derived from different basic materials, possessed common agricultural characteristic and a silica alumina ratio between 3 and 4. The large tract of Indo-gangetic alluvium was almost alluvial in nature. The soil profile in this case did not appear to be so important as it was elsewhere, but surely it should be possible to differentiate profiles even in this huge block of alluvium with reference to the relative intensities of rainfall, evaporation and temperature. The ratio of rainfall to temperature for the different parts of India varied from 0.10 to 1.5. A broad classification of areas might be made into,

North-East India,
North-West India,
North Central Alluvial India, and
Peninsular India,

which again could be sub-divided on the ratio basis and classified with respect to texture and composition.

He would be glad if speakers would kindly bear in mind these points and confine their remarks to the methods of survey that might be considered necessary on an All-India basis.

Messrs Wadia and Roy spoke emphasising the geological aspect of soil survey. Dr. Puri discussed the means of approach to the problem and the methods to be employed and suggested that a committee of people engaged in soil survey should draw up an agreed programme of work and co-ordinate results. Mr. Wadia said that valuable data are available from Settlement Surveys and that they should be examined and utilised. He gave data collected by him in Central India. Rao Saheb Bal spoke with reference to the soils of the Central Provinces and Dr. Kashinath on the soils of the Madras Presidency.

In the course of his address Sir John Russell said that he would confine himself to indicating various directions in which local surveys can profitably be made.

In regard to the cultivable wastes of 150 million acres mentioned by Mr. Viswanath one cannot help feeling that there is a good deal of it that could even in present conditions be brought into cultivation, and one advantage of a survey will undoubtedly be that it will enable us to ascertain which are the most promising areas for reclamation.

In regard to manurial experiments a good deal of information had already been obtained and this will be extended now that modern methods are so widely being used. A soil survey in relation to the area served by the experimental station affords an effective method of showing how far the experimental results are likely to be applicable in practice.

Further, there is the problem of irrigation. I attach great importance to making a proper survey of any region that it is proposed to irrigate. Trouble from water logging is likely to follow irrigation unless the scheme has been planned as guided by a previous soil survey. I could give instances from different parts of the world which I have visited where the scheme considered from the engineering point of view has been admirable, but from the soil point view it was bad.

Coming now to the important problem of classification, several methods have been used. The earliest was textural. Then came the geological basis; then climatic then the profile basis. All are useful, but objection can be taken to all of them. Geological data, however, are invaluable for providing information in respect to water-supply, where it is essential to know the nature and position of the various strata, their permeability and their relation to the ultimate supplies of water. Studies of this kind would be useful in famine areas.

Other problems of soil survey arise in connection with forestry. Forest conservation is an effective way of reducing or even preventing soil erosion.

Problems connected with laterite soil and black cotton soils offer exceptional scope for study in India.

One of the modern methods of soil survey is to have it on the soil profile. Unfortunately, most of the Indian soils I have seen have no very marked profile such as can be seen in other parts of the world. A good deal of soil work is being done in India and it would undoubtedly be a great advantage to put all local surveys on to a uniform basis so that the results can be collated and brought together. It is not necessary to adopt any

one basis of classification. Soil investigators are by no means agreed on the matter and numerous systems have been proposed. The important point at the present time is that the soils should be fully described and the same methods of description should be used by all Indian soil workers. Dr. Puri's suggestion is sound that the Indian soil workers should constitute a committee to draw up an agreed basis for describing the soils and should indicate the methods of examination to be adopted. It would further be necessary to arrange for some central body to prepare the maps and so to put data on record that will be useful to all concerned with soil management and with agriculture.

Mr. Champion read a note prepared by Dr. Gorre with reference to plant cover and said that before deforesting soils for agricultural purposes, sufficient consideration should be paid to the soils, protective and water storage aspects of the natural plant cover.

"Practically all sloping grounds in the drier parts of India are of some importance as a source of water to the plains dwellers either for irrigation, town water or electric power, and its efficieney in catching and storing water depends very largely on how far the natural soil profile has been maintained and developed by preserving the natural plant cover."

"I submit that any form of soil survey which may be taken up should cater for this method of land use. The survey should register the relative efficiency of the existing plant cover in maintaining the optimum soil profile, and it should also indicate whatever changes are taking place in the building up or degradation of the existing profile. The view point which regards soils in situ as enirely static and permanent will fail to give a record of permanent value because in many areas the soil profile is being rapidly destroyed though bad agricultural and pastoral practices. The soil survey must take cognisance of this fact and one member of each mapping party should be sufficiently erosion-conscious to be able to record obvious tendencies of this nature. The cumulative denudation which is taking place in many parts of the western provinces is leading inevitably to desiccation."—(*Abstract from the Current Seience, April 1937.*)

SOME THERAPEUTIC USES OF INSECTS AND THEIR PRODUCTS

While it is true that insects as a class are far more harmful than beneficial, there are many species whose habits make them friends. We think at once, of course, of such well known insects has honeybees, silk-worms, plant pollinators and parasites of injurious species. But besides these, there are a few which play a part in the treatment of disease.

One of these is an ancient enemy now being made to serve as a benefactor. I refer to malarial mosquitoes, at present being used in the treatment of paresis or paralysis associated with syphilis and insanity. Mosquitoes which transmit malaria are no doubt among the world's most injurious insects, but their deadly habits are being adapted in this instance to serve a beneficial purpose.

Malarial treatment of peresis —Through casual observations that fewer cases of paresis appeared among those who had malaria, there gradually developed the presumption that possibly the malarial organism had something to do with this matter. This led to artificial inoculation, in cases of paresis, with blood from persons having malaria.

The female mosquitoes are fed upon patients who have had tertian malaria produced by vivax. After feeding, the females are placed in an incubator for about two weeks, until they become infectious. They are then ready for use, but if not needed at the time they can be kept in a refrigerator a little above freezing until required. Fortunately these mosquitoes go into hibernation readily in the refrigerator, and in fact they can survive the low temperature longer than the malarial organism within them.

It is not necessary to bring the patient to the mosquito in order to have him bitten. The mosquitoes infected with vivax are sent to the patient and allowed to feed on him. This transmits the organism, which then starts up a chain of events called malarial on fever therapy. To make malarial mosquitoes play a part in relieving a disease like paresis is surely turning the tables on the mosquito.

A technique has recently been developed which makes it unnecessary for the mosquito to bite the patient at all. The infected salivary glands are now being dissected and their contents injected into the blood stream. The gland contents remain potent for 26 days after dissection.

Bee-venom treatment of arthritis.—We are turning now from the consideration of a deadly insect and shall discuss briefly the use in medicine of a species which has long been classed as beneficial the honey-bee. In the history of man's long association with bees, stories have appeared in folklore and in other writings, that beekeepers are less troubled with arthritis than people in other occupations. For centuries this was disregarded, or at any rate it failed to awaken enough interest to start an investigation of the matter.

Details are meagre regarding the gradual development of interest in this peculiar subject. Apparently the earliest attempts to use bee venom in the treatment of arthritis consisted in forcing bees to sting the victim repeatedly on the affected parts. Hundreds of stings appeared to be necessary to bring about any noticeable improvement, and the treatment was naturally very painful. The results of this crude method of treatment appeared favourable enough, however to stimulate further curiosity in the treatment and further experimentation.

The next step taken was a logical one. Poison sacs were dissected in large numbers from bees, and specified quantities of the venom were injected with a hyprodermic needle.

Thus, a small industry arose in Germany a few years ago around this treatment. It consisted of breeding bees for their venom. Women, suitably protected with nets, sat in rows in front of the beehives. They caused the bees to sting into some sort of material which held the stings and poison sacs. The sacs were then collected and the venom extracted. Doses containing a certain quantity of venom in solution were prepared and were injected into the affected parts of the body.

This was a more scientific technique than allowing bees to sting the body, but it was still very painful. It seemed, however, to be sufficiently interesting to warrant further study and effort.

This was followed by another method, namely, of mixing the venom with an ointment and applying it to the skin where needed. This is one of the methods at present in use. In England there are at least two concerns now preparing bee venom in an ointment. It is sold in tubes like tooth-paste and in two strengths, medium and strong. The tubes are marked on the outside into a number of sections, one for each day, and the treatment consists of sqeezing out the required dose, placing it on a

piece of cork which comes with the tube and rubbing this daily into the skin.

Blister beetle extract.—Probably one of the best known examples of insects used in medicine is that of the blister beetle or "Spanish fly.' The juice is extracted from the crushed bodies of certain blister beetles of the family Meloide. The extract contains a substance called cantharidin and when the extract is applied to the skin it causes severe smarting followed by painful blisters.

This treatment arose from a practice of great antiquity in medicine It was the peculiar custom many years ago to apply irritation to the skin in the treatment of internal diseases. The belief was that the disease could be drawn from the deeper organs to the surface by irritation of the skin. A later theory was that the beneficial results of this treatment were obtained by withdrawing liquid from the diseased organs to the skin aud thus relieving congestion. This theory has been held until comparatively recent times. Actually it has been found that irritation of the skin does relieve pain and congestion in some instances. The practice of treating internal organs by external or counter-irritation still persists.

Maggot therapy of non-healing wounds.—We now come to a recent therapeautic use of insects which seems to have aroused a vast amount of interest among both the medical profession and the laity. I refer to the use of blowfly maggots in the treatment of chronic non-healing and discharging wounds. This is a case of actually rearing maggots for the purpose of placing them in wounds to stimulate healing. It is only seven years since the first published report of this treatment was made, but in that time it seems to have reached the ears of every-body, doctors and laity alike. The interest is probably due to the remarkable healing effects obtained and to the novel and repugnant nature of the treatment.

Extract from macerated maggots.—To overcome some of the disadvantages of live maggots in the wound, an effort was made about four years ago in the United States to substitute the juices from the crushed bodies of maggots. The watery mixture thus obtained was filtered and a weak antiseptic added to prevent putrefaction. The liquid was then applied to the wound on wet gauze dressings. This method appeared to be less repugnant and was very easy to apply. Unfortunately however, it was still more expensive than live maggots.

To the surprise of many, the application of the crushed extract to discharging wounds had much the same healing effect as the maggots. This was confirmed by experiments in France, Spain and South America. The extract has a wider application than maggots, as it can be used where they could not. For instance, the extract has been used in the treatment of middle-ear infections and it has also been sprayed up in the nose with excellent results. One individual in the United States even obtained a patent two years ago for a method of preparing an extract. Something disagreeable or impractical about this method seemed to persist, however and it too has fallen into disuse.

Allantoin.—While on the subject of maggot extracts I might mention to you something of what the Bureau of Entomology and Plant Quarantine is doing in a study of these extracts. The attempt was made about two years ago to isolate and identify whatever healing agents there are present in the natural excretions of maggots (not the crushed bodies). This investigation led to the finding of a substance called allantoin in the excretions. Clinical tests of the healing effects of this material were made by a number of physicians and surgeons in the United States, and their report showed that allantoin produces results similar to those of maggots. Allantoin is now being produced chemically and independent of maggots. It is used chiefly in a water solution, and the treatment consists of keeping in the wound moistened with the solution. It can be applied on wet gauze dressings or, if the wound is deep or extensive, the solution can be irrigated on with a syringe.—(*Jour. of Economic Entomology*)

SULPHURING OF PINEAPPLE SOILS

Within the past few seasons the application of sulphur to pineapple soils has been widely practised, and its effect has been of great value in the control of pineapple "wilt disease". The function of sulphur is not that of a fertilizer; its value lies in the fact that it will increase the acidity or pH of the soil. It is now generally recognised that, under certain conditions, an acid soil is required for pineapple cultivation, and this is particularly the case with regard to the sandy forest areas.

The chief reason for this is that with the increased, acidity the iron in the soil becomes more readily available to the plant. The presence of iron is necessary for the functioning of the chlorophyll, which is the green colouring matter of the plant leaf.

The amount of iron in the sandy forest is very low, and, as usually

only a small part of the iron is available to the plant, it so happens that, after being cropped for a year, this iron is all used up. The condition may be remedied by the application of sulphur, for, with the resulting increase in acidity, a sufficient quantity of iron will again become available. The response to this treatment can be detected by observing that there is a general improvement in the colour of the plant, and the new growth will be green and vigorous, in marked contrast to the pale, lifeless appearance of the previous condition.

With the heavier types of loams, and in particular the volcanic loams, the application of sulphur is not always necessary, due to the sufficiency of available iron naturally present in the soil. However, it is a fact that in many of these heavy soils, which contain normally ten to twenty times the amount of total iron of the sandy soils, there is only a very small amount of this available, and consequently there will be a definite response of sulphuring.

In sandy soils, the pH test may be regarded as an index of the availability of the iron, and except in the case of some virgin areas, if the pH is much above five, the application of sulphur can be confidently recommended. The amount of sulphur varies with the soil, but generally $2\frac{1}{2}$ to 3 cwt. per acre should suffice for the light-coloured very sandy types. For those which are of the nature of a sandy loam, a heavier dressing of 4 to 5 cwt. per acre is necessary. With loams, and the red volcanic soils, dressings of less than 6 to 7 cwt. per acre are of little use, and, moreover, before these heavy dressings are made, advice should be obtained as to whether they are necessary, and will warrant the expenditure.

As the period in which the effect of sulphur becomes noticeable is about one to two months in the summer and at least three to six months in winter, it is advisable to apply it as soon as possible, *i. e.*, a month or so before planting. The land should be brought to a fine tilth, and the sulphur broadcast by hand. Powdered sulphur is on the market; it is of the required degree of fineness, and is cheaper than the very fine flowers of sulphur. If at all lumpy, it should be rubbed through a sieve before distributing, in order to ensure an intimate admixture of the sulphur particles with the soil. The best time to apply is early in the morning, or on a still day, and it is very advisable to wear some form of protecting goggles, as the fine particles of sulphur cause considerable irritation to the eyes. The sulphur is then scarified into a depth of about 4 inches; this is preferable to turning it in deeper by ploughing.

Sulphur may be applied with benefit to plants showing iron deficiency, up to twelve months old; the response, however, is not as marked as when it is applied before planting. In this case, it should be applied to the soil fairly close to the base of the plant, and then chipped in. It must be clearly understood that the sulphur should be applied to the soil itself, and that any portion lodging in the base of the leaves will be wasted. Note that this is different from fertilizer practice, for sulphur, unlike a fertilizer mixture, must be applied directly to, and thoroughly incorporated with the soil for any re-action to take place.

Finally, it must be pointed out that the health and growth of the young plant is all important, and therefore the great value of sulphur lies in its use as a preventive and not as a cure.—(*From Queensland Agricultural Journal Vol. XLVIII, Part 4 of 1st April 1937.*)

IMPROVEMENT OF LIVESTOCK

Care of Pedigree Cattle

Villages to have Stockmen

Among the subjects set down for the next week's Cattle Conference in Simla are the establishment of provincial cattle improvement funds on the lines suggested by the Conference of Animal Husbandry, held in Madras last December, improvement of grass lands, better utilisation of waste with surplus land for fodder production, and need for increased technical personnel for improved livestock improvement work in the country.

Duties of Stockmen.—The creation of a new figure in Indian Village life,—a stockman—may result from the discussions of the All-India Cattle Conference to be opened by the Viceroy in Simla on May 25.

One of the most difficult problems in the way of those who are trying to improve livestock in India is that of looking after pedigree-stock once it has been obtained and saving it from deterioration through lack of care. Accordingly, the Conference will discuss the proposal, to recruit youths from among ryot classes interested in live-stock, to give them a short period of training and then offer them employment as stockmen,

The duties of these stockmen would include first aid for livestock, vaccination and inoculation, registration of accredited stock, tattooing and branding of animals, dipping operations, sanitary propaganda work, assistance in field investigation work and giving advice generally to village people on the care and management of animals. This would be a further step in arresting the grave deterioration in live-stock of India, brought out in the report of Royal Commission on Agriculture in 1927.

As the first step, research institutes and experimental farms have been set up and have already achieved valuable results. A point has now been reached where it is necessary to obtain staff for the retention of this work to villages. First, there must be efficient officers in each province for staffing the livestock improvement section. It is felt that such staff could be obtained from the local agricultural, veterinary and forest colleges if the training imparted is given a bias in the direction of livestock improvement. At the same time in livestock work, the Conference will be bearing very clearly in mind that when selecting officers, one of the main requirements is a good "eye" for animals which is usually born or developed from constant association with animals from youth upwards.

Briefly, what is felt to be required to arrest the very serious deterioration experienced in Indian cattle, as a result of overwhelming multiplication of cattle population, is (a) registration of accredited progeny of approved bulls, (b) maintenance of bulls through a fund to be established in each provinces, (c) formation of cattle breeding societies, holding of cattle shows and award of sanads (d) castration of all inferior stocks, (e) permanent protection against rinder-pest of all registered stock free of cost and (f) provision of suitable supplies of fodder.—(*Hindu May 18th 1937.*)

IRRADIATION OF PLANT WITH NEON LIGHT

After years of experiments in Holland and elsewhere, an appreciable measure of success has recently been achieved in promoting the development of plants by irradiation with artificial lighb. J. W. M. Roodenburg and G. Zecher, in a paper in Philip's Technical Review (Edindhoven) of July last describe recent technical developments, and show that it is now possible for the market gardener and the amateur horticulturist to employ irradiation on a practical scale.

The growth of plants is naturally intimately connected with their photosynthesis. As photosynthesis is most active in red light, it is necessary to use red rays. Twenty years ago neon light was suggested, but this light is not so easy to manipulate as glow lamp light, so further experiments were made with glow lamps. These showed that although the development of leaves was promoted, the general quality of the plants suffered, as the stems and stalks grew too 'leggy'. Experiments have now shown that provided the proper 'dosage' is given, neon light is exceptionally suitable for plant irradiation. The stems become thicker, the roots are stronger and frequently the formation of blooms and fruits is much promoted.

When neon lights were introduced for the irradiation of plants, they had already been employed for several years as luminous advertisements. For these purposes long glass tubes are used, into the ends of which two iron electrodes are fused. The tubes contain a neon filling at pressure of 3,000 volts and emit a comparatively small luminous flux per metre of tube-length. For use in damp forcing houses for the irradiation of plants, these tubes would be objectionable owing to the risk of shock; moreover, their low brightness makes it difficult to obtain the best illumination. To get a satisfactory illumination, it was necessary to reduce the pressure to 1 mm. or less. But at this pressure the iron electrodes disintegrated rapidly, so that the life of a tube was only a few hours. A solution was obtained by using hot cathodes similar to those used in gas-discharge tubes for highway lighting. This enables the tubes to be run at low pressures.

The hot cathode tubes are connected directly to 220 volts mains supply, through a series, connected 'choke' coil. A simple device is employed for starting up the tube, since the running voltage is too low to initiate the first electric discharge through the low-pressure neon gas. During the burning of the lamp, the cathode suffers practically no

disintegration and the light output remains uniform. After 2,000 hours the cathode begins to be atomized and a black deposit forms on the glass walls. The tubes should then be replaced. The tubes are short and mounted in reflectors which considerably increase the efficiency of the irradiation.

Photographs are given which show the effects produced by subjecting flowering plants and strawberry beds to irradiation for periods up to three months at eight hours per night in mid-winter. Compared with plants which have not been treated in this way, the forcing effect is very pronounced.—(*Abstract from Nature April 24, 1937.*)

ROLE OF SILICON IN THE PLANT

A series of papers upon this subject by A. Sreenivasan has recently appeared (Prac. Indian Acad. Sci., 1,2 and 3). The inquiry appears to have arisen out of the fact that the rice plant, which accumulates exceptionally large quantities of silicon in its ash, grows so satisfactorily under swamp conditions. This raised the question whether swamp conditions are particularly favourable for silicate supply and also raised anew the question as to the role of silicon in the plant. An extensive series of experiments with rice, grown both in swamp and dry soil conditions showed that whilst both phosphate and silicate manurial treatments increase yield, silicate is particularly useful in raising the yield from manured arid soils to practically the same level as that in swamp soils. The conclusion is reached that the swamp conditions, therefore, are suited to the rice plants because thus large amounts of silica are supplied to the plant which would otherwise remain unavailable The role of silicon still remains obscure; the author points out that its accumulation may be a secondary result of growth in swamp conditions which are otherwise favourable to the plant, for example, on account of the resultant presentation of nitrogen to the root system in ammoniacal form. The mode of entry of silicon into the plant also remains obscure but this detailed examination has cleared up many points as to the behaviour of silicates in the soil, to which they contribute both an alkali and a silicate gel, and as to their significance in the manurial treatment of the rice crop.—(*Abstract from the Tropical Agricultural Vol. XIV No. 4*)

ARE SOUR ORANGES DUE TO LACK OF PHOSPHORUS.

The acidity of Valencia oranges was increased by the application of potassium Sulphate (25 lbs per tree but was decreased by applications of either superphosphate or bone-meal (40 lb per tree). Phosphate fertilizers also increased the juice content of the fruit. Fertilizers had relatively little effect on the total solids in the fruit, changes in the solids to acid ratio being due chiefly to changes in the amount of acid. The effect of the fertilizers, particularly bone-meal was greater when they were applied in trenches dug around the trees to a depth of nine inches, and then forked into the root zone, than when they were applied broadcast on the surface of the soil about the trees and then forked in. Phosphate fertilizers increased the phosphate content of the juice from 0.027 to 0.030 to 0.038 per cent, but had no effect on the potassium content. Potassium sulphate increased the potassium content of the juice from 0.20 to 0.21 to 0.24 to 0.25 per cent, but had no effect on the phosphate content. South African Valencia oranges contain only about half as much phosphate as those grown in California.

(*Abstract from the Tropical Agriculture Vol. XIV No. 4*).

FEEDING AND HANDLING EXPERIMENTS

Feeding and Handling Experiments on the Pusa Pedigree Sahiwal Herd conducted over a period of 3 years have given very useful results (1932-35).

The changes which were introduced in the system were :—

(1) a reduction in the ration of concentrates to 1 lb for 3 lbs of milk yield.

(2) Milking the cows four times a day at equal intervals instead of twice as was being practised.

(3) Milking the cows seven or ten days before calving to remove udder trouble which was associated with heavy secretion of milk prior to calving.

The system has proved itself during the three years and has definitely shown the following advantages :—

(i) It has raised the herd yield.

(ii) It has reduced the cost per pound of milk.

(iii) It has not increased the general expenses on the herd.

(iv) No general ill effects either in loss of weight, udder trouble, sterility or standing off have been noticed.

(v) The standard of calves produced has been fully maintained.

(vi) It has proved itself the most efficient method of testing the Milk capacities of all cows.—(*Agric & Live Stock in India Vol. VII part II March. 37.*)

THE GRAZING PROBLEM IN INDIA

In order to utilize the diminishing grazing areas of India to the fullest degree the author suggests that attention be given early to the following items of work in this country.

(i) Soil and plant surveys.

(ii) Analysis and feeding trials of fodder from typical areas.

(iii) Introduction of new grasses legumes, edible shrubs, etc.

(iv) Prevention of erosion by-"bunding" and other simple methods.

(v) Provision of a well distributed supply of drinking water.

(vi) Pasture management including controlled and rotational grazing, fencing, etc.

(vii) Possibilities of fodder conservation-dry storage and ensilage.

(viii) The restriction, where possible of the number of permits issued for grazing, so as to allow of the proper development of the area and preservation of desirable grasses.

(ix) The permanent protection of all animals against rinderpest before permits are issued.

(x) The castration of all scrub bulls with two teeth or over, unless an enhanced grazing fee is paid.

The author also suggests that one of the departments must be entrusted with the duty of developing the areas set apart for grazing to the fullest capacity.—(*Agri & Live Stock in India Vol. VII part II March 1937.*)

AGRICULTURAL PROGRESS OF THE PUNJAB

Punjab Economic Boards' Report.

The Punjab is now one of the richest and most progressive provinces of India and its transformation from the chaos and anarchy of the forties of the last century forms one of the romances of modern Indian history. When the province came under the British in 1849 it was in a very bad way. There were large groups of disbanded soldiery roaming over the country side, settled occupations were few, cultivation was mostly dependent on a capricious rainfall, and the limited irrigation was from wells or a few inundation channels fed from uncertain riverfloods. The last ninety years have seen amazing changes, of which the greatest has been in the introduction of a system of canals which has now few rivals in the world. These canals have brought abundance to large tracts of arid, dreary land, which now constitute the canal colonies, perhaps the most flourishing agricultural area in India.

The Board of Economic Inquiry, Punjab, has recently issued as its 52nd publication a report entitled "*Agricultural Statistics of the Punjab, 1901-2 to 1935-6*", which gives a bird's-eye view of the steady progress in the agriculture of the province. The main section of the book consists of fifty-six tables giving annual statistics of the following: the area of the Punjab and its classification into forests, fallows, sown area, culturable waste and unculturable land; the average rainfall of the province, as well as, in seven selected districts representing areas of high and low rainfall; the respective acreages under well–and canal-irrigation; areas (and in some cases the outturn also) of 35 individual crops; live-stock censuses; land revenue and its incidence per head of population and per cultivated acre; sales, mortgages and redemption of land; harvest prices; and estimates of the total value of the crops produced.

The first part of the report is devoted to an explanation of the tables and in addition contains several useful summaries which give a clear view of the agricultural position in the years dealt with. Although the main statistics refer to the present century, figures have been taken as far back as possible. For example, it is shown that the population has increased from about 16¼ millions in 1868 to 23½ millions in 1931, and in the same period the cultivated area has risen from 20 million to 31 million acres: the greatest increase being in the canal-irrigated acreage which has risen from 1.4 million to nearly 13 million acres, a rise of about 805 per cent.

The capital outlay on productive canals (i. e., on those which were constructed to yield a profit) amounted up to 1935-36 to a little more than 33.3 crores of rupees and the net receipts of the Punjab Government from irrigation, both directly in water rates and indirectly in land revenue charged to such lands amounted to 3.99 crores of rupees or 39 per cent of the total revenues of the Province. The value of the crops sown on canal lands amounted in 1935-36 to 39 crores of rupees. The figures also show that in the thirty-five years since 1901 whenever the Province has had in one year a rainfall of about 35 inches, the next year it has received only about half this amount, i. e., a very wet year has been followed by a very dry.

The aim of the report is to compress within a small compass useful information relating to land and agriculture. The datas are at present found in the annual reports of various government departments and it takes much time to look through a number of these volumes to extract figures on any specific topic. At the same time the tables in these reports are at times presented in a manner not easily comprehensible to the ordinary reader. This book is designed for the use of officials legislators, business men and students; the public will also find much of interest in it since on agriculture depends the future prosperity of India in general and the Punjab in particular. The report may be had from any bookseller for eight annas only.

RED PALM OIL.

The oil derived from the fruit of the West African Palm, elaeis guineensis, is very rich in carotene, the precursor of Vitamin A. Chemical tests conducted by Lt. Col. R. E. Wright I. M. S., Professor of Ophthalmology, Government Ophthalmic Hospital, Madras, have shown that Red Palm Oil is as effective as Cod Liver Oil in the treatment of several cases of human keratomalacia. In a number of cases rapid improvement took place in cases which remained living under the indentical domestic conditions in which they had developed the syndrome, the only change in their daily routine being the addition of Red Palm Oil emulsion to their diet. In addition, the progress of cases in hospital on Red Palm Oil and Cod Liver Oil was carefully compared. While Colonel Wright points out that clinical investigations of this nature are necessarily less clearly defined than laboratory investigations under carefully controlled conditions, he has nevertheless fully convinced himself of the effectiveness of

Red Palm Oil. The decision of so experienced a worker can be accepted as conclusive.

If Red Palm Oil cures kerotomalacia, then its carotene must be capable of satisfying the daily Vitamin A requirements of human beings.

Considering the costs, it has been calculated that the amount of Vitamin A purchasable for a given sum in the form of Red Palm Oil will be about 3 times greater than that purchasable in the form of Cod Liver Oil. The fact that Red Palm Oil contains little or no Vitamin D unlike Cod Liver Oil is not necessarily a drawback to its use in countries where Vitamin D is supplied by abundant strong sunlight and rickets is rare. In India it could be used in the South and other parts where Vitamin A deficiency is common and Vitamin D deficiency not a serious problem.

The question of introducing the palm elaeis guineesis into South India should receive attention on the part of agricultural authorities. The climate of South India would probably be suitable for its cultivation. (*Nature May 1937.*)

MAYNARD GANGA RAM PRIZE

Prof R. S. Jai Chand Luthra, I. A. S., Professor of Botany has been awarded the prize for 1935, in consideration of his researches on the control of Loose Smut of Wheat. This disease is prevalent in most parts of Punjab and causes considerable loss to cultivators. The old method of control involved treatment of the wheat before sowing with hot water and unless carried out by skilled workers, it was prone to affect the germinating power of the seed. Prof. Luthra's method which is far simpler, consists in treating the seed merely in water at ordinary temperatures for four hours during the morning of a day in summer, after which the soaked seed is spread out to dry in the sun. Experience has shown that this treatment is effective in controlling the disease.

The award for 1932 has also now been announced. The recipient of the prize is Mr. T. A. Miller Brownlie, lately Agricultural Engineer to Government, of Punjab, for his invention of a slip strainer suitable for water augmentation of supplies derived from bores sunk in open wells. This strainer has the particular merit that it is not affected by alkaline sub-soil water.

The award which is of the value of Rs. 3,000 is due to the munificence of the late Sir Ganga Ram Kt, C. I. E., M. V. O., R. B.,

who in 1925, handed over to the Punjab Government a sum of Rs. 25,000 for the endowment of a prize, to be awarded every 3 years for discovery or an invention or a new practical method which will tend to increase agricultural production in the Punjab on a paying basis. The competition is open to all, throughout the world.

The first award which was due in 1929 was made in 1931, to Dr. Barber, late Imperial Sugar Expert, for his fundamental discoveries which resulted in the production of Coimbatore Sugarcane.—(*Nature May 1937.*)

A CURRENCY FOR INDIA

By Maurice Frydman

In the beginning, articles of human need were simply bartered and the rate of exchange depended on the relation between demand and supply. With development of the agricultural life and trade the necessity of standards of value arose, and it is remarkable, that the first standards were based on articles of immediate necessity: grain, cattle, cloth. Further development of trade created a need for an easily portable standard and first metal in general and finally gold was adopted. Adoption of a gold standard used at that time for jewellery and vessels only, coincides with a very high degree of general prosperity, when the demand for articles of first need was satisfied to a great extent, and when trade was catering to big towns and courts. Political development introduced State treasuries and a problem of replenishing them—large payments had to be made and this led to standardised metal pieces, called coins. Kings, usually badly in need of means of payment, manipulated with the coins, and their value decreased steadily, or in other words, prices were going up. Development of banking introduced paper values, which later developed into paper money by the same process of State manipulations. Ultimately paper money has replaced gold coins every where and gold has become now an article of trade like others, while currency and prices are ruled mainly by legislation.

The tradition of basing the value of paper money on the amount of gold the State will pay on demand is becoming more and more obsolete. There are very few States that will freely give gold to their citizens in exchange of paper notes. In international relations payment in gold is still current, but the general tendency towards balancing the imports and exports whenever possible by means of commercial treaties or currency

depreciation has for its main purpose the elimination of gold from international relations.

The fallacy of gold as standard of value can be well shown if we take an extreme example.

A country called Eldorado is lined with gold bricks, but is, apart from this, completely barren. Its inhabitants will pay with gold for war material to protect themselves and other goods to maintain themselves. The gold received in payment by the countries producing goods will be stored in bank vaults and paper money issued to finance industry and agriculture to produce more goods demanded by our Eldorado. Provided the supply of gold bricks is big enough, the Eldorado State will flourish without producing anything, while other States will slave for it. The accumulation of war material may even lead to a political supremacy of Eldorado and all becuase other States have a fancy for hoarding up gold in their treasuries.

This may be an indirect test, but direct tests also show the unsuitability of gold as standard of value. The history of the last few hundred years of the West is a history of mankind suffering from gold poisoning. The production of gold does not go parallel to the development of the means of production and this leads to deep anomalies in the world trade and to periodical depressions. To consider them as natural would be to consider periodical attacks of malarial fever natural. They are sign of disease, of lack of balance between production and consumption, in short, of an unsound currency system.

The gold standard is also not moral in the sense of interfering with the self-evident right of every individual to self expression. The shifting of the centre of gravity on a substance which is not an article of immediate and universal need has dislocated the attitude to life of average man. Possession, and not service has become the goal. Everybody wants to have something, and not to be something and to do something. The harm, such mental distortion of outlook is doing to the individual and society cannot be over-estimated. Imagine the cells of your body obsessed with the idea of getting fat; some tissues, capable of collecting fat will become monstrously obese, while others, the brain and the nervous system first amongst them, will suffer acute emaciation. The bankers of the system, the heart and the liver will accumulate fat and will work lazily, which will lead to still bigger deposits of fat in some of the tissues.

To say that the same happens in our present day society will not be an exaggeration.

To improve matters a change of attitude towards money is necessary. Gold is a static standard, it encourages possession and not production and consumption.

Enormous amounts of human effort are spent on digging out the gold from one pit, called "mine" for putting it into another pit, called "bank". Since gold does not satisfy human needs, it stands to reason that the labour is a complete waste. As a matter of fact paper currency could be issued on the basis of the gold content of the soil of the country with the same effect.

The very chemical stability of gold, praised by its partisans is rather a drawback. A depreciation currency would be infinitely better for the general welfare. But a depreciating currency alone would not be sufficient.

We do not maintain that currency reform alone will heal all wounds. It is not possible. Currency is only a tool, a technical detail of social organisation; but the right choice of a tool may have a far-reaching influence. Give mankind a standard of value that favours accumulation–it will accumulate. Give it another standard, that will encourage production and consumption-it will produce and consume with the same enthusiasm.

In our search for the most suitable form of currency for India we shall take the country as it is, and not as we would like it to be.

The main problem of India is the problem of a most appalling poverty, probably even worse than in China. One-fifth of humanity is living on or below the mere level of subsistence. The average income of an Indian is 7 ps per day.

Poverty cannot be abolished by State or private charity, however generous and extensive. One may be fed on doles " Winterhilfe " " Soupes popularies " or " National relief funds " and yet remain in the same state of wretchedness. All the unemployment schemes, etc., are nothing but production of beggars on a mass scale. Workmen dislike intensely these schemes; unearned bread is tasteless for them. They

postpone physical starvation, but mental and moral starvation remain the same. Vast millions are reduced in their human dignity and their capacity for work is wasted.

In India no unemployment or poverty-relief is yet organised. It is natural becuase poverty and unemployment are too general. Contrary to other countries, total employment is the privilege of a minority here. The vast majority of the population is partially or totally unemployed. All the resources of the employed part of the population will not be sufficient to finance even the most modest unemployment scheme.

Complete abolition of poverty involves a thorough economic reconstruction of which a currency reform is a single aspect only.

Whether it will take in India the shape of a State socialism, or of a God socialism, it is not for us to venture an opinion.

Thus, the system of currency we are in search for, should be designed so that its work automatically tends to diminish poverty, in other words; (1) It will favour production; (2) It will facilitate proper distribution; and (3) It will encourage consumption. Apart from this the proposed currency should be easily understood and accepted by the poverty-stricken man himself i.e. it cannot be an abstract currency, based on price indexes or other statistical averages.

In looking through the list of human needs we find that the first is food. Its importance is out of proportion to any other. In moments of distress the satisfaction of all other needs will be sacrificed for the sake of food and family affection only proves sometimes equally strong. Food being the first necessity it is also the biggest single item of man's production. More effort is spent on the production of food than on every thing else taken together. Food is also the item in which insufficiency of production, distribution and consumption is most intolerable. It makes the availability of all other necessities of life worthless.

Let us imagine that by some magic, India is deprived of all amenities of civilisation but given an abundance of pure and healthy food. A nation of well-built nudists, walking briskly from Rameshwaram to Badrinath for a stroll, begetting sturdy little boys and girls in a happy promiscuity, worshipping, if at all, Sri Annapurna only and friendly to

each other because there would be absolutely no reason for being otherwise, may look grotesque to our worry-eaten minds, but whoever loves man for his own sake will not deny that it would be an acceptable proposition.

Food being the first and by far the most important need of man, which, when required, will be willingly exchanged against anything else the following idea occurs immediately.

Why should not the most common and urgent necessity be made a standard of value? Will it work better? Will it fulfil the requirements of India? Will currency based on a food standard be the "morally sound currency" system for India?

The first thing to note is that a food currency is not a new idea. It exists and works on a small scale in all purely agricultural communities. It still exists in the Indian village economy. It is in harmony with Indian traditions. It is in the very blood of the villager, and the villager is India.

In ancient times gold was stored by tradesman, kings and temples; the villager knew paddy only. Till very late even taxes were paid in grain and the only contribution to be paid in gold and silver were the homages offered to the ladies of the household.

The introduction in India of a foreign economic and industrial system has destroyed the village economy and ruined the very foundation of the country's prosperity. Everything had to be paid with money, with rupees, annas, pies and money has become a nightmare. Its value in terms of grain was changing constantly. Significant is the fact that the villager says: "so many measures of rice for a rupee" and not "so many rupees for a measure of rice". It is because he had to purchase rupees for payment of taxes, debts, implements, cloth, etc., Yet, in his mind grain remained the standard of value and not money, which he had to get to pay off all his harassers till the next season.

Let us now make clear, what exactly we mean by the term "food currency"; with its introduction, what would be its influence on the agricultural and industrial life of the country, in what way will it affect production, distribution and consumption and how will it influence Indian trade relations with other countries.

By "food currency" we understand a system of currency in which a staple food product of the country is taken as a standard of value. In India it will be a chosen variety of paddy and wheat. A certain quantity of paddy or equivalent from the nutritive point of view, a quantity of wheat will be chosen and called a rupee. To distinguish it form the old rupee the new rupee may be named food-rupee. For purposes of convenience value of food-rupee standard may be so chosen, as to represent the value of a rupee in terms of grain at a rate most suitable from all points of view.

Legislation will have to be passed: (1) to convert all gold obligations: (2) to control the import and export of currency grains: (3) to open State granaries, (4) to fix once for ever, the quantity of currency grain in a food-rupee, (5) to fix the seigniorage levied by the State when exchanging currency grain for currency notes.

The seigniorage is necessary to avoid the Government to become a merchant in grain. It may be one to two annas in the rupee, which will allow a margin of profit to all big and small grain merchants that will continue their trade within the limits of seigniorage, similar to the gold brokers of to-day.

The state granaries do not need to be many nor very big. If free railway transport of State grain is introduced, every station master may be authorised to issue food currency notes against currency grains and send the bags of grain to the State granaries.

Private hoarding of food currency notes will be prevented by proper legislation devaluing old currency notes, unless deposited in savings banks.

An additional legislation of immense importance, although not directly connected with the currency reform would be the transfer of a part of land revenue to a Crop Insurance Fund, out of which compensations for total or partial crop failure will be paid.

Let us now visualise the change as clearly as we can. We shall assume that the reform is already about 3 years old, and the storm of protests, declarations, petitions, resolutions and interpellations has subsided and the big grain merchants have chosen another field of money making, that the villagers have thoroughly learned the welcome news

that there will be no more variation of price of crops, however abundant the crop may be and the grain consumer has also learned that he does not need to pay grain above a certain rate, printed on every currency note in his pocket. The grain ports are usually deserted. Apart from this not much changes will be found in the towns.

The real importance of the reform will be seen in the village. Every plot of land becoming virtually a gold mine and every villager a gold digger, unusual activity is observable every-where. Grain has verbally become money, by growing grain money is grown and everybody knows well in advance how much money is going to be grown. Every piece of land is utilised, irrigation schemes are put to execution, the selected grain varieties are sought for, agricultural improvements quickly popularised, best implements purchased, every village humming with activity because for the first time in history the grain grower is sure of the crop, its price, its market.

Demand and supply relations govern other agricultural products, and their culture will not be forsaken, as their price will be always controlled by the value of grain that can be grown on the same land with the same amount of labour and usually they bring some small premium to the enterprising grower.

Every villager knowing exactly how much value he is growing every year, is enabled to lay out a budget and to have his own private 5 year plan. The indebtedness of the village has become possible to cope with as the stabilised income of the villager has enabled the State to give long-term interest free loans on the security of the crops.

The industrial development of the country is tremendously accelerated. The currency notes the villager receives for his grain he has either to spend or to save. He spends on industrial products like carts, bullock, shoes, lamps, hard-ware, paper, etc. The amounts saved are utilised by the Government for financing big irrigation and electrification schemes, reclamation of waste lands, building roads and railways. In both cases the money goes to the industries. As the industries develop and their own costs go down, price of industrial products in terms of agricultural products go down, enabling the villager to purchase more and more. Thus the development of industries follows closely the rise of prosperity in the villages.

The State has profited in several ways. It's land revenue is stabilised and growing from year to year. The seigniorage has created a new source of income. The prosperity of the population is increasing steadily, any local famine is dealt with by Crops Insurance Fund, and there is plenty of reserve funds for any major scheme. Food, being the currency itself, no need of curtailing its production is ever felt; when abundant quantities accumulate in the granaries extensive sanitation, town-building and road-building schemes are financed, educational facilities extended and children, maternity and old-age protection schemes introduced. Heavy inheritance taxes curtail the accumulation of too big savings, money is grown intensely and spent intensely and proper balance between production and consumption maintained all the time.

Except for the severe control of currency grains imports and exports, little change can be observed in the international trade mechanism. The Food-Rupee being an international currency, the international trade accounts are cleared by a special bank agency which keeps foreign money between exports and imports- The country's gold production, useless now for the internal economy, is more than sufficient to meet any foreign obligations, if they have to be paid in gold.

Needless to say that although the food currency will make a tremendous difference in the economy of the country and may open a new era in its development, as long as the land will be in the hands of land-lords, it will make them very rich and also very dangerous. The new scheme will benefit them in the first instance. The tenants, usually left with just enough to live on till the next season, will get their benefits only indirectly, owing to increased demand for industrial and rural labour.

Yet any failure to give plenty to every individual in India will not be the fault of the currency system, but of other aspects of the present economic structure. The scheme by itself is able to foster production, facilitate distribution and increase consumption.

Can the reform be introduced immediately ? Surely. It will make everybody's life easier. It requires a very simple legislation. It benefits the State and the citizen in the same measure.

Can it be introduced in a smaller area than the whole of India ? Yes, provided two conditions are fulfilled.

(1) The chosen area can grow some excess of food over the needs of the population; (2) Its revenue is entirely independent and it has no outside charges; and (3) It has got freedom to regulate its imports and exports.

Some objections may arise and it will be useful to answer them in anticipation.

(1) Is it necessary to make food the currency itself? Will not a grain price policy based on State granaries do the same?

No, it will not do as although it stabilises the prices to a certain extent, it will always be subject to the whims of the Governments and does not give the certainty, that the food currency itself can only give. Apart from this, the gold poison will not be eliminated.

(2) Will not a food currency lead to over-production of grain? No, becuase human needs are various and with the increase of prosperity the population will create a demand for other agricultural products, that will become more paying to produce, than grain.

(3) The food currency will foster barter transaction in the rural areas, with the elimination of currency notes.

It would be a welcome procedure, eliminating the middleman completely and giving to those concerned the full value for their services.

(4) It will be difficult to collect taxes in grain.

Taxes will be collected as useful, in currency notes. Exchange of grain against currency notes is done separately, preferably by the station masters.

(5) The State will incur heavy losses by accidental deterioration of grain.

The modern granaries can keep grain for very long periods. If the reform is passed by the Government, we undertake to design air conditioned and ventilated granaries in which grain will keep as long as in the Egyptian Pyramids.

(6) A heavy load will be put on railways.

Not at all; State granaries will not be big at all. The majority of grain transactions will pass through private hands, who will desire to profit by the seigniorage. Apart from this the increased railway traffic, due to higher prosperity, will pay off the railways generously the necessity of sending a trainload of grain free.

(7) Excess of grain will accumulate in State granaries.

Grain is a starting point in a variety of chemical industries. It can be dumped away by the State. A large percentage to be exchanged for grain and the excess of grain can be sold to licensed chemical industries at lower rates or exported.

It is impossible in a single article to go into all the details of the scheme and to discuss all the corollaries. However utopian it may look at the first sight, it is a simple, understandable scheme. It deserves consideration and we are sure that a generation will come that will take it seriously and put it to practice.—(*Nature May 1937*)

Crop Forecasts

WHEAT CROP IN C. P.

Final Forecast.

Character of the season.—During the first three weeks of April storms accompanied by rain and hail occured at intervals all over the province causing some damage to the harvested crop. Since then the weather has been clear and hot. Harvesting is over and threshing and winnowing which were interrupted by the rain are now in full swing.

Area.—The area under wheat in the Central Provinces and Berar together stands at 3, 165,622 acres which is smaller than last year's actual area of 3,389,153 acres by 7 per cent. It also falls short of the quinquennial and decinnial averages by 8 per cent. The decrease is chiefly confined to the cotton districts due to expansion of the kharif areas.

Outturn.—As a result of further enquiry into the damage caused by cloudy weather, frost, hail and rust, the outturns reported in the third forecast have been lowered by 7½ points in the Hoshangabad, Nimar, Wardha, Bhandara and Balaghat districts, by 15 points in Saugor,

Jubbulpore and Nagpur districts and by 30 points in the Mandla district. The provincial outturn now works out to 78 per cent of the normal as against 75.8 per cent in the previous year.

Expressed in tons, the yield for the whole province amounts to 609,300 tons as against the actual yield of 641,000 tons of last year.

Prices.—The wholesale prices of wheat prevailing in the principal markets of the province during the month of April 1937 ranged from 26 to 68 per cent higher than in the corresponding period of last year.

MUSTARD CROP IN C. P.

Final Forecast.

The area sown with rape and mustard in the Central Provinces and Berar together is estimated to be 70,842 acres as compared with 67,6320 acres, the actuals of last year an increase of 5 per cent.

Rain and cold winds when the crop was in flower slightly affected the outturn which was expected to be more than normal. For the province as a whole, the outturn is estimated to be 98 per cent of the normal with an approximate yield of 16,800 tons as compared with an outturn of 81 per cent and an actual yield of 13,300 tons, last year.

LINSEED CROP IN C. P.

Final Forecast.

The final forecast of the linseed crop of the Central Provinces and Berar for the season 1936-37 says :—

Character of the season.—In the first three weeks of April storms accompanied by rain and hail occured at intervals all over the province and caused some damage to the harvested crop. Since then the weather has been clear and hot.

Area.—The provincial area as now estimated to be 1,131,083 acres (drilled 697,828 and broadcast 433,255 acres) which is greater than the area 1,111,814 acres, reported in the second forecast by 2 per cent and is nearly equal to the actual area, 1,131,234 acres of last quinquennial and decinnial averages by 23 and 21 per cent respectively.

Outturn.—The crop suffered to a varying degree owing to cloudy weather, frost and rain at the time when it was in flower. Absence of timely winter showers also stunted the growth of the broadcast (utera) variety of the crop in the Chattisgarh districts. Rain and hail in March and April caused some further damage to the crop collected on threshing floors. As a result, the estimates of outturn reported in the second forecast have been lowered in 15 districts from 38 to 15 points. The Deputy Commissioner, Hoshangabad, alone has raised his estimate by 7.5 points i. e. from 82.5 per cent to 90 per cent. For the province as a whole the outturn now works out in 79.5 per cent of the normal against 72.7 per cent the actual outturn of last year.

Expressed in tons, the yield for the province as a whole, works out to 85,500 tons of last year and increase of 5,900 tons or 7.5 per cent.

Prices.—The wholesale price of linseed prevailing in the principal markets of the province during the month of April 1937 raised from 9 to 41 per cent higher than in the corresponding period of last year.

College News

The Fourth year students toured in Chhatisgarh Division in the month of October to study the rice crop and they visited the three main Farms of the Circle namely Labhandi, Chandkhuri and Drug. The Deputy Director of Agriculture, Eastern Circle, delivered a lecture on the Economic conditions of the tract and the consolidation Officer explained the consolidation work in the Circle and the results achieved therefrom; while the Extra Assistant Director of Agriculture gave an account of the various experiments that were being conducted on the farms in the circle. The Rice Research Officer gave a short account of the results achieved so far and the experiments that were in progress.

It is usual for the 2nd year students to go on excursion tour to study sugarcane cultivation and gur making. This year they visited Betul Farm. Besides the routine work they saw one Private Farm of Mr. K. L. Rawat, the leading malguzar of the place, where they discussed with the malguzar the economic aspects of cane cultivation.

The Third year class visited two of the main Farms of the Northern Districts-Powarkheda and Adhartal and one Farm of Southern Circle-Chhindwara.

Powarkheda Farm represents the typical wheat growing tract of the Nerbada Valley. The two chief soils of the tract are the Maryar and the Morand. The former is a heavy deep black soil generally lying level and is only suited for Rabi crops, while Morand could be devoted for kharif crops also.

The cattle of the Breeding Farm consist of pure bred Malvis which are in great demand as they are the kind of cattle needed for the tract. The Malvi breed is a typical draught breed.

The Agricultural A. V. M. School at Powarkheda is very popular as is seen by the number of students that are being admitted every year. The students and staff were full of enthusiasm and entertained our boys in several ways.

At Jubbulpore the " Haveli system of wheat cultivation was shown. The Military Dairy and Grass Farms and The Perfect Pottery works were also visited. One afternoon was spent in visiting the famous marble rocks between which the Nerbada river flows. After seeing the beautiful fall the party had a pleasant boating in the river amidst the magnificent marble rocks.

* * * *

The students had the proud privilage of hearing a very instructive and inspiring address from Sir John Russel, the Director of the Rathamstead Agricultural Research Station, England, on the 8th of January 1937 during his visit to Nagpur along with Dr. Wright, the British Dairy Expert, in connection with the Scientific stock-taking of the Imperial Council of Agricultural Research in India. The members of the staff and some distinguished guests were also present.

Sir John expressed that he has been interested in this province for the last nearly 30 years as he had occasion to know intimately two of its Officers Mr. F. J. Plymen C.I.E., and Rao Saheb D. V. Bal who had both worked on the Rathamstead Farm with Sir John Russel the former before he came to India and the latter a few years ago when he had been to Rathamstead for higher training. He was pleased to note the various activities of the Department which have been helpful to the cultivators and he concluded by emphasising that the countryside was waiting for the B. Ag's to go back to their villages and set an example to the rest of their community by properly cultivating their lands and leading an honest and upright life.

Departmental News

1. Leave on average pay for two months is granted to Rai Sahib G. R. Dutt, Entomologist, Central Provinces with effect from the 2nd April 1937.

* * * *

2. Leave on average pay for four months is granted to Mr. J. S. Gurjar, Extra Assistant Director of Agriculture, with effect from the date of his reversion to British Service i. e. from the first May 1937.

* * * *

3. Leave on average pay for one month is granted to Mr. M. S. Barker, Extra Assistant Director of Agriculture, Hoshangabad with effect from the 7th May 1937 or any subsequent date on which he is permitted to avail himself of it.

* * * *

4. Leave on average pay for thirteen days is granted to Mr. Ram Narayan Kayasth, Extra Assistant Director of Agriculture, Nagpur, with effect from the 17th May 1937, with permission to prefix the holidays on the 12th to 15th and Sunday the 16th and to affix Sunday the 30th May 1937 to the leave,

* * * *

5. On expiry of the leave granted to him Mr. Ram Narayan Kayastha, Extra Assistant Director of Agriculture is reposted to Nagpur.

* * * *

6. On expiry of the leave granted to him Mr. N. S. Gangakhedkar, Extra Assistant Director of Agriculture is reposted to Akola.

On relief by Mr. N. S. Gangakhedkar Mr. A. H. Barde, Offg. Extra Assistant Director of Agricutture, Akola, reverts to his substantive appointment in the Subordinate Agricultural Service.

Examination Results 1936-37

B. Ag. EXAMINATION, NAGPUR UNIVERSITY

Second Division.

Jitendralal Sen *
S. S. Kufallikar
A. B. Mittra
D. P. Persai
Gaj Raj Singh
Mohd. Luqman
R. D. S. Joshi
S. P. Pimpliker
V. N. Andhare
W. S. Dehadrai

Third Division.

B. V. Bhatt
M. K. Deosker
P. L. Harinkhere
S. M. Shariful Hassan

Pass.

N. V. Bapat.

Under the provisions of paragraph 11 of Ordinance No. 18 the following examinees are declared eligible to present themselves at one or more subsequent examinations, only in the subject noted against their names:—

Agricultural Chemistry.

H. N. Mukerji
Mohd. Nasiruddin

* Sir Arthur Blennerhassett Memorial Medal is awarded to Jitendralal Sen for standing first at the B. Ag. Examination of 1937.

I. Ag. EXAMINATION, NAGPUR UNIVERSITY

First Division.

M. C. Gangrade *

Second Division.

Asgharali Raja
C. B. S. Saigal
D. C. Jain
D. R. Yadava
D. G. Dakshindas
M. V. Gokhale
N. Y. Karkarey
S. S. Tomar

Third Division.

B. G. Ghawghawe
G. R. Tatwawadi

* Sir Arthur Blennerhassett Memorial Medal is awarded to M. C. Gangrade for standing first at the Intermediate (Agriculture) Examination of 1937,

Pass.

M. D. Patil
P. K. Mukerji
R. C. Kurmi
T. G. Deshpande
V. D. Deshpande
Y. R. Saoji

(Under Paragraph 12 of Ordinance 17).

Pass.

G. P. Deshpande

Under the provision of Paragraph 12 of Ordinance No. 17 the following examinees are declared eligible to present themselves at one or more subsequent examinations, only in the subject noted against their names:—

Mathematics and Agricultural Engineering.

B. H. Tembhre
B. S. Shukla
H. S. Thakur
N. B. Gupta

FIRST YEAR PROMOTION EXAMINATION

In order of merit.

1. G. R. Shirpurkar.
2. V. B. Mandlekar.
3. B. W. Lakhe.
4. S. K. Gangarade.
5. J. P. Nema.
6. G. W. Choube.
7. V. W. Deshpande.
8. Y. V. Salpekar.
9. R. C. Deshmukh.
10. Sheonath Sakelle.
11. K. J. Deshpande.
12. H. P. Naik.
13. Abdul-Wali.
14. S. A. Joshi.
15. Y. M. Mokashi.
16. R. B. Jalit.
17. R. V. Gumasta.
18. S. R. Abhyankar.
19. K. G. Bhide.
20. R. S. Chauhan.
21. M. V. Kothekar.
22. W. W. Purohit.
23. K. R. Shasrabudhe.
24. G. D. Hishikar.
25. S. N. Joshi.
26. T. V. Rama Aiyar.
27. N. P. Shrivastava.
28. S. S. Khokale.
29. G. R. Patankar.
30. K. Mohansingh.
31. B. K. Zinjarde.
32. A. M. Rokade.
33. V. R. Deshmukh.
34. W. G. Naseri.
35. M. J. Khare.
36. R. N. Tiwari.
37. V. S. Jamdar.
38. V. L. Golhar.
39. A. N. Sil
40. S. V. Shambarkar.

41. M. H. Huddar.
42. S. Y. Ali Shah.
43. B. G. Wakhale.
44. P. H. Pashine.
45. Mohd. Sadique Amin.
46. P. C. Khare.
47. N. P. Shakargayen.
48. W. P. Ghushe.
49. P. C. Verma.
50. B. H. Ramekar.

THIRD YEAR PROMOTION EXAMINATION

In order of merit.

1. M. K. Reddy,
2. W. B. Date.
3. M. G. Kamkolkar.
4. P. M. Shrivastava.
5. B. L. Chaudhari.
6. M. S. Kiledar.
7. G. S. Bagwat.
8. G. R. Shembekar.
9. M. A. Kolkhede.
10. Mohd. Shoaib.
11. B. P. Upadhya.
12. G. P. Deshpande,
13. M. K. Das.
14. V. G. Deodhar.
15. P. R. Roday.
16. W. S. Vayawahare.
17. S. K. Hussain.
18. T. N. Supe.
19. N. T. Saoji.
20. V. S. Kulkarni.
21. P. V. Bapat.
22. R. K. Wadaskar.
23. G. V. Dhoke.
24. V. S. Saoji.

Review

(A Handbook of statistics for use in Plant breeding and Agricultural Problems by F. J. F. Shaw, C. I. E., D. Sc., A. R. C. S., F. L. S.

Dr. Shaw had a strong passion for the comparatively recent science of Agricultural Statistics. He was fully aware of the difficulties while puzzeled the students, who attended the special course of lectures on statistics in agricultural work delivered by him. He has placed all those who are associated with agricultural research, under a deep debt of gratitude by writing a " Handbook of Statistics for use in Plant Breeding and Agricultural Problems ". It can safely be said about the book that there is none better existing on the subject. The book explains in a simple, clear manner with minimum technical Phraseology a subject which, had it not been for the fact that it has been handled in a masterly fashion, confusing as it is, would have been worst confounded by improper handling. We are sure Dr. Shaw's posthumous publication will be welcomed as an invaluable guide on the subject of lay out and interpretation of Field experiments.

The Central Provinces and Berar Gazette

EXTRAORDINARY

Nagpur, Tuesday, May 25, 1937.

PROGRAMME OF THE GOVERNMENT OF THE CENTRAL PROVINCES AND BERAR

The accompanying frame work of policy and programme laid down by Government is published for general information.

PROGRAMME

The dominant motive of Government will be the amelioration of the lot of the cultivating classes, and measures directed to this end will be their main pre-occupation.

1. *Land revenue assessments and administration.*—Having regard to the recognized inequality in the pressure of rents and revenue in the different parts of the Province, Government propose to examine the question with special reference to the areas where the pitch of assessments is suspected to be markedly above the average, with a view to readjustment where necessary. The question of the incidence of tenants' rents in izara villages in Berar will receive particular attention, and, if it is found that reduction is necessary, steps will be taken to give relief. Although, according to the current settlement theories in the province, rents in the Central Provinces and revenue in Berar are so fixed as to be payable without difficulty in an indifferent season as well as in a good one, the necessity of granting suspensions or remissions on account of the general or local failure of crops has always been recognized. Government are aware of complaints that the

relief so given is not adequate, and in order to remove any possible grievance on this score Government intend to re-examine the principles regulating the grant of suspensions and remissions, and, if necessary, to liberalize them.

2. *Tenancy legislation.*—In regard to land tenures in the Central Provinces the problem that has most exercised the minds of those responsible for land revenue administration is the conferral of transferable rights in land on tenants and raiyats. Government will seek to find a satisfactory solution to the problem and will examine the desirability of *(a)* the grant of absolute occupancy rights to all occupancy tenants, and *(b)* the conferral of power to alienate on raiyats in raiyatwari villages in the Central Provinces.

3. *Extension of grazing facilities and colonization.*—Concerted measures will be taken not only to facilitate the cultivation of land already occupied, but also to extend the area occupied by promoting colonization schemes. In connection with the former objective, Government will consider the feasibility of extending the operation of Consolidation of Holdings Act, which has succeeded so signally in the old Chhattisgarh districts, to other areas in the province. The possibility will also be examined of extending the system of reserving grazing areas and preventing the further breaking up of uneconomic waste land in order to ensure adequate grazing facilities in malguzari villages. In connection with the second objective, steps will be taken to accelerate the settlement of arable waste lands by the announcement of attractive terms to colonists. In order to secure for the cultivator conditions favourable for the unhindered pursuit of his vocation, measures will be devised for the prevention of various kinds of illegal exactions by malguzars and petty Government officials.

4. *Surcharge on land revenue.*—The malguzari system of the Central Provinces is the creation of the State, and the

experience of the last 50 years has shown that the state has been unduly generous, at the cost of the general tax-payer, to the proprietory body, which are no more than the agents of the State for village management. This has been largely responsible for the growth of an undesirable phenomenon—the absentee landlord. In order to check this, Government propose to investigate the desirability of imposing a surcharge on land revenue payments in excess of a prescribed amount. Another aspect of the same problem is the privileged payments made by the holders of Zamindari estates. Experience has dissipated the hopes that were entertained that the benefit of the concession would be indirectly passed on to the peasantry. In the larger interests of the province, therefore, Government propose to examine the question of the feasibility of enhancing the percentage of assessable land revenue taken—takoli—from the proprietors of Zamindari estates.

5. *Agricultural finance and rural indebtedness.*—In the sphere of agricultural credit and rural indebtedness, the aim of Government will be to supplement and perfect the measures already taken in recent years. The adequacy of the scale on which taccavi loans are advanced at present will be examined and the feasibility considered of extending it so as to provide about 15 per cent of the amount required annually to finance agricultural operations. Government contemplate not only the establishment of more debt conciliation boards in order to give the benefit of their operation to parts of the province where they are needed, but also in attack on the problem of debt redemption from another angle: they will examine the possibility of introducing legislation for the setting up of permanent machinery for the reduction and liquidation of excessive debts in rural areas by the application of the principles of insolvency law to agriculturists, with suitable modifications. Further, to ensure that the borrower gets a fair deal, the control of money-lending will be tightened up

by means of a system of licences and fixation of maximum rates of interest and credit limits.

6. *Co-operative credit.*—In the allied sphere of co-operative credit, Government intend to find a solution of what is among the most perplexing problems of the department—land in the possession of central banks. Large areas have passed to them in default by borrowers, and the position is fraught with danger from the co-operative point of view. A scheme will, therefore, be evolved for the restoration of such land, to be followed by legislation to prohibit the involuntary acquisition of land by corporations other than land mortgage banks in future. At the same time the number of land mortgage banks will, as far as practicable, be increased so as to extend the facilities of long-term finance to the whole province.

7. *Agricultural practice.*—In the wider field of agricultural practice, while the extension of orange cultivation and horticulture will be promoted and measures will be devised to discourage the use of cow dung as fuel by providing facilities for obtaining fuel at cheap rates, Government's chief concern will be the improvement of agricultural stock. The establishment of a large scale cattle-breeding farm is contemplated, and a definite scheme to that end is already under consideration. Government are also considering the desirability of applying the Cattle Diseases Act to the frontier districts of Saugor and Hoshangabad and of establishing quarantine stations in these districts with the object of preventing the spread of cattle disease by the migration of cattle through them to other parts of the province.

8. *Irrigation.*—Of the many problems arising in connection with irrigation, Government intend immediately to tackle the two most pressing ones—

(i) The general question of encouraging an extension of the agreement system by an examination and readjustment of irrigation rates, and

(ii) the question of handing over small and unremunerative tanks to the Revenue Department or to panchayats of villages.

9. *Forests*—In administering forests, transferred to popular control for the first time, every endeavour will be made to study the interest and convenience of the cultivator Thus, administrative measures will be devised to ensure a greater degree of control over forest subordinates in order to prevent harassment of the public. The question of increasing the number of cattle per plough that are allowed to graze at privilege or ordinary rates will be examined and steps will be taken to remove the forest boundary further from the village habitation in all cases in which it is at present inconveniently close from the point of view of the villagers.

10. *Aboriginal areas.*—Government regard the development of aboriginal areas as their special concern and intend to pursue with vigour measures for the advancement of these areas by the provision of improved communications and greater medical, public health and educational facilities as well as by promoting general uplift and by the control of the activities of outside money-lenders and by other means.

11. *Public health and medical facilities.*—As regards public health and medical facilities in the province generally, Government recognize that the scope for improvement is almost unlimited. Effort will, therefore, be directed towards drawing up a plan of development and expansion of public health services and medical facilities and executing it as rapidly as the resources of the province will permit. There is, however, one scheme of

urgent importance, which Government intend to take in hand with the greatest possible speed, and that is the conversion of the present Mayo Hospital into a first grade modern hospital, worthy of the capital of the province, and the conversion of the Robertson Medical School into a Medical College.

12. *Education.*—Even more extensive is the field of endeavour in the Education Department, and optimum development is limited only by financial capacity. The needs of the department that demand and will receive immediate attention are :—

(i) Development of mass education, including girls' primary education and adult education, and liquidation of illiteracy,

(ii) Legislative measures to transfer the control, management and administration of primary education to the State,

(iii) Educational reconstruction and vocational education, including the problem of the educated unemployed,

(iv) Improved facilities for the teaching of Agriculture in vernacular middle schools,

(v) Establishment of more village libraries in rural areas, and

(vi) Restoration of the percentage cut in maintenance grants to schools and colleges and payment of building and furniture grants withheld during the period of financial stringency.

13. *Industrial development and welfare of labour.*—In the sphere of industry, Government attach great importance to the

introduction of subsidiary occupations or industries in villages in order to provide the cultivator with the means of supplementing his income in the off season, and efforts will be made to introduce suitable industries for this purpose. A serious handicap to the formulation of any ordered plan for the industrial development of the province is the absence of statistical data regarding the present stage of progress, and an attempt will be made to remove this obstacle to development by putting into operation a scheme that has already been drawn up for an industrial survey of the province. The welfare of the industrial worker will not be neglected, and immediate attention will be paid to the solution of the problem of improving the housing conditions of labour. Investigation will be undertaken with the object of determining in what way Government could best foster the development of electric power stations in the province with a view to the supply of cheap electric power for industrial and other purposes.

14. *Finance and retrenchment.*—In devising ways and means for financing the programme the requirements of sound finance will be borne in mind, and no effort will be spared to ensure that the burden on the general taxpayer is minimized. Government have already appointed an informal Retrenchment Committee to examine the entire administrative machinery and to review the expenditure of all departments, in consultation with heads of departments, in order to find out what scope there is for re-organization and economy and the cheapening of the cost of administration. An examination is already in progress of the cadres and conditions of service of various services with a view to the eventual reduction of scales of pay, where possible, and of the number of highly paid posts.

Eat more fruit
अधिक फल खाओ

राग—शंकरा　　　　　　　　　　　　　　　　　　ताल—त्रिताल

स्थायी

फल, फल, फल, नित फल खाओ ।
रक्त, अस्थि, बुद्धि, शक्ति बढ़ाओ ।
शक्ति सकल सम्पति चतुर निवेदहिं ॥

अंतरा

दाल, भात, लड्डू, पूरी, कचौरी ।
हैं अहार पर नहिं पूरण ।
इनमें नहिं हैं मिलत 'व्हिटामिन' ।
जिन पर निर्भर शरीर सुख ॥ १ ॥

पान, सुपारी, सिगरेट, टी, काफ़ी ।
इनके सेवन से बीमारी ।
जो चाहो वैद्य का पैसा बचाना ।
फल रूपी परमौषधि खाओ ॥ २ ॥

मध्यप्रदेश में, ईश कृपा से ।
सन्तरे, कदली, आम, पपीता ।
सुलभ रीति से इनकी उपज है ।
प्रियवर ! इनकी खेती बढ़ाओ ॥ ३ ॥

B. S. Rao

Sow good Seed
अच्छे बीज बोओ

राग—सारंग ताल—झम्प

स्थायी

आरहा है समय ।
बीज बोने का भाई ।
बीज जैसे बोओगे ।
फल वैसे पाओगे ॥१॥

अन्तरा

मिट्टी, खात, हवा, पानी ।
इनसे होती उपज घनी ।
यह सब निरुपयोगी ।
जब बीज है रोगी ॥१॥

सड़े, पुराने, कीड़े ।
खाये, मिश्रित बीजे ।
चाहे मिलें बहु सस्ते ।
तौ भी इनको नहीं बोना ॥२॥

हम किसानों के लिये ।
कृषि कार्य विभागों ने ।
बीज भंडार खोले ।
सखे ! इनसे लाभ लेना ॥३॥

B. S. Rao

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Editorial

Our readers, we are sure, will be very much grieved to learn that J. C. McDougall, Esquire., M.A., B.Sc., Director of Agriculture C. P. and Berar has been compelled to go home, on account of serious illness, on seven months leave. We wish him speedy recovery so that he may be at the helm of the affairs of the Department of Agriculture, Central Provinces and Berar for many more years to come.

We offer a very hearty welcome to R. H. Hill, Esq. M.A., (Cantab). Deputy Director of Agriculture Economics and Marketing, C. P., who has been appointed to officiate during Mr. McDougall's absence on leave.

Our hearty congratulations to G. D. Mehta, Esq. B. Ag. who has been appointed to officiate as Deputy Director of Agriculture Economics and Marketing, C. P.

RURAL HEALTH

It is highly gratifying to note that the attention of the Government is being concentrated on matters relating to rural health in the country. Large sums of money have been spent in improving the sanitation of big towns and even in beautifying them. The metropolitan cities of India, no doubt, deserved all the

attention bestowed on them but one cannot help thinking that while this was being done, the countryside which is real India was almost neglected. It seemed as if the cart was being put before the horse. We have seen how enthusiastically the Viceroy's appeal for supply of pedegree bulls to the villages was responded to, by the public. We are equally hopeful that the Viceroy's anxiety for the Villager's health will inspire all those who by means of power or wealth can interest themselves in rural uplift to bless the villagers with health, the greatest form of wealth. India's wealth which is mostly Agricultural wealth is intimely bound up with the health of the cultivators. In absence of labour saving machines the importance of the health of the labour force available, for Agricultural operations, cannot be sufficiently emphasised. The Indian peasant is described as a lazy, non-enterprising, home sick fellow. He would not have been the unhappy recipient of these epithets, had it not been for his body being physically unsound either due to under-nutrition, or a chronic disease like malaria afflicting him. Those who have visited villages in Chattisgarh cannot but sympathise with the cultivators, a large percentage of whom carry enlarged liver and spleen. The cultivator, exposed as he is to sudden fluctuations of climate, falls a victim to diseases like Pneumonia recovery from which is left to chance. Even after recovery a long lapse of time is necessary before he can work on his fields. Several skin diseases and even venereal diseases are prevalent among the villagers which render them unfit, for work for long periods.

Large areas of cultivable waste land in India are awaiting the plough. But the prevalence of diseases, particularly malaria, discourages Agriculturists from colonising such tracts. Chanda district in C. P. may be cited as an example. Irrigation tanks have been constructed and water stored, but attempts to induce people from the neighbouring tracts to come and settle down have failed on account of the Malaria fright. Extension of roads into these areas whereby medical aid and other amenities of life could

be easily kept within reach should remove the existing obstacles in the way of colonization.

A properly nourished body can resist diseases. In India it is said that very few villagers get two meals a day. Most of them are said to live on only one meal and some even on half a meal. The diet is not only insufficient in quantity but defective in quality not containing the health giving vitamins. Prevention is certainly better than trying to cure. At present the cry is that most of what the cultivator grows is sold to find the necessary cash wherewith to pay the land rent and part payment of accumulated interest on loans contracted either by himself or by his forefathers, and that the balance of grain left is hardly sufficient to keep his body and soul together. We hope that the reforms which are on the anvil will be effective in guaranteeing to the cultivator out of the produce of his efforts a share necessary for his maintenance.

Adequate water supply, for drinking and sanitary purposes is a great necessity in many villages. Many skin diseases are traceable to want of facilities for bathing and washing clothes. The toll taken by Cholera is too well known.

Disposal of human waste near villages admits of plenty of improvement. By having moveable latrines or trenches under shade, the night soil, which is now allowed to go to waste, and breed diseases could be converted into a valuable manure and increase crop yields.

THE RESERVE BANK AND RURAL FINANCE

With the inauguration of the Reserve Bank of India high hopes were held that the financing of Agriculture in India would be improved as one of the primary functions of the Reserve Bank is to co-operate with the existing machinery for accommodating the Indian cultivator with both long term and short term loans, of which he is so frequently in need, at the lowest rates of interest,

Unfortunately during the period the Reserve Bank has functioned it could not extend its helping hand in this direction, the reason given being that the Bank had to satisfy itself regarding the soundness of the existing organizations with reference to their financial stability, their lines of business, maintenance of accounts etc. The Reserve Bank seems to have indicated that the responsibility of scrutinising the genuineness of bills should fall on the Scheduled Banks, as they are in a better position to come into contact with the agriculturists in any particular tract. As a guarantee that the advances made by the Reserve Bank will be safe it has laid down certain conditions which should be fulfilled by the Scheduled Banks before they can look to the Reserve Bank for help. At the session of the All India Co-operative Institute and Provincial Banks Conference held in Bangalore, a sense of disappointment was expressed at the attitude of the Reserve Bank in trying to study the position of the Scheduled Banks instead of giving some aid immediately and then suggesting improvements in the interests of all parties concerned. The Reserve Bank seems to have also relegated to the back ground the Indegenous Banks that are actually in intimate contact with the agriculturists and are the chief financiers at present in the rural economy. It has been estimated that 70% of the financing is done by the Indegenous Banks. The Scheduled Banks are neither sufficient in number nor easily accessible to the cultivators. Many of the Indegenous Banks have put their business on right lines, and have fallen into a line with the Scheduled Banks regarding maintenance of accounts, etc. If these Indegenous Banks are recognised and encouraged their usefulness to the country is expected to be very great. The Reserve Bank will be fully justified in insisting that the Indegenous Banks should show sufficient capital. But if on the other hand these banks are expected to deposit large sums as securities for loans obtained very few Indegenous Banks will be able to satisfy this condition. Many of the Indegenous Banks are flourishing on account of the personalities behind them. But this factor in itself is a great asset. If

certain concessions are not given to these Indegenous Banks in recognition of the great service which they have seen rendering in the nooks and corners of the country, it is feared that the help which the Reserve Bank wants to extend to the Indian cultivator through only the Scheduled Banks will be very inadequate. It has been suggested by the Reserve Bank that the Indegenous Banks should apply for aid through the Scheduled Banks. It is very doubtful whether the Indegenous Banks will be willing to submit to this sort of supremacy of the Scheduled Banks over them. It is also pointed out that if the Reserve Bank does not want to deal with the indegenous Banks directly but through the intermediary of the Scheduled Banks there will be not only delay in giving relief but also an increase in the expenditure.

THE "PHOOKA" EVIL

We are very glad to learn that a campaign has been started in Bengal to fight the "Phooka" evil by the societies for the prevention of cruelty to animals. With the blessing which the campaign has received from the Viceroy we are sure that this heinous practice which cows are subjected to by the gaolies will be completely exterminated. Before applying for legislation as the last resort the gaolies should be influenced by all means to give up this cruel practice. In Calcutta there is already in existence an Association which is working with the set purpose of exterminating this evil. The "Phooka" is practised regularly twice a day on each cow. The legs are tied to bamboo posts and two men hold the animal so that the animal cannot make any movement of the body. A bamboo pipe about 2 feet long 2 to 3 inches diameter is introduced into the generative organ of the animal and air is blown into the generative organ causing it to distend. On account of the inflation, the extra pressure on the glands enable the milkman to draw every drop of milk in the udder. Although scientifically it is very sound that milking

should be complete to stimulate the mamnary glands and prolong the lactation period the "Phooka" method adopted is highly condemnable. The cows after this operation are found to swoon on account of the excruciating pain. It is no wonder that cows and baffaloes subjected to this process become sterile in course of time.

A some what similar practice is sometimes employed in this Province also in the case of cows and buffalloes which refuse to let down their milk. The tail of the cow is thrust into the generative organ. On account of the great pain the animal is no longer able to hold up the milk. The effect of the injury to and introduction of dirt into the generative organ in this process is to render them sterile or susceptible to contagious abortion. Such cruel practices certainly should be stamped out by all means.

Original Articles

AGRICULTURAL INDEBTEDNESS—A WORLD PROBLEM

N. M. JOGLEKER M.A., LL.B.

The Problem of agricultural indebtedness has assumed great importance in India during the past few years. Almost every farmer is suffering very heavily under the weight of the debts incurred, either by him, or by his ancestors or by both. He is pestered day to day, by the anxiety to meet the demands of the money lender, while the great need of getting some monetary advance for carying on the agricultural operations has been the cause of his anxiety, year to year. He might have contracted the debts either for economic or non-economic causes, all the same, the fact remains that he has now found it beyond his means to meet the situation. The debts are so heavy, that, it is quite impossible for most of the farmers to wipe out their liabilities in a few favourable seasons, which, as ill luck would have it, have become quite rare.

The effect of this position is worse, if we look to the future. The problem is, as it were, of a cumulative nature for, indebtedness persists in keeping the farmer indebted for ever. In any year, if there is a surplus left with him, he is never to benefit out of it, by employing it towards further production, as this is the only chance for the money-lender to satisfy his long due debts. This shows how indebtedness is coming in the way of any future progress, by bringing to a standstill, all the activities that an ambitious cultivator may undertake, for want of sufficient finance. A systematic policy meant to face this problem of wiping out the old debts, and to stem its growth once for all, is absolutely necessary, as a groundwork for the future development of agriculture.

This task is of course of a very difficult nature. It is not possible for the state to wipe off all the indebtedness by a single stroke of legal enactment, for this involves a conflict with the interests of a large class of the public, i e. the money lending class, which has been the most useful and the most essential financial agency, though of a crude nature, for centuries in the past, and which cannot be completely replaced for years to come. Nor is it possible for any state, to redeem all the debts, by a generous grant from the government treasury, and particularly at the present times, when the deficit budgets have become the order of the day.

The only way out, appears in sketching out a programme which would last for a number of years, and which would lead to the gradual extinction of the debts, without introducing any serious unrest in the different classes of the public, or without introducing any repercussions on the money market of the country. It should be particularly noted here that great care will have to be taken in this connection, in guarding against the possible danger that the cultivator may become more and more irresponsible about his financial position, if he begins to feel that he can escape, to a certain extent, the after effects of his own doings. Nor will it end the problem here, for the cultivator may become reckless by spending much on uneconomic purposes, which may again invite the hornest's hest round him. This will simply mean the recurrence of the present position. A corresponding policy of educating the debtor, to a practice of judicious and controlled credit will have to be introduced.

The Royal Commission on Agriculture in India, has aptly recommended this measure in the following words, "we wish however to make plain our opinion that no legislation however wise, or sympathetic can save from himself the cultivator, who through ignorance, or through

improvidence is determined to work his own ruin. Education and the development of character are the sole specifics against both the wiles of the lender and the recklessness of the borrower."

Our Province has already given a lead, by passing the Debt Conciliation Act, and by establishing Debt Conciliation Boards, which have worked so successfully in scaling down the debts of the agriculturists to a substantial extent. Attempts are also made to circumvent the practice of usury by means of the legislative measures which have been recently taken. These are embodied mainly in the usurious loans amendment act, the money lenders act and the reduction of interest Act.

As this problem is being taken up very seriously in other parts of India as well, the discussion over similar problems, and the methods adopted in tackling it, in other countries, will be most opportune. For, most of the countries in the world which carried on a considerable agricultural industry, have suffered very hard, in the recent years, because of the phenomenal fall in the prices of agricultural products, which was a marked feature of the recent economic depression. As a result of this, agriculture became quite unremunerative, and the farmer's debts could not be repaid. Year by year, the debts grew to such an extent that, the problem of indebtedness has now assumed an alarming position. Many countries therefore came to the rescue of their agriculturist by giving liberal loans from the coffers of the Government, and by promulgating various legislative measures which facilitated the repayment of the old debts. I have endeavoured, in the following pages, to review the problem of indebtedness, as it appeared, in the various countries and to describe the various measures that were resorted to, in meeting it.*

CANADA

The nature of the Problem.—The recent economic depression during the years 1929 to 1932 placed a great number of farmers in a state of insolvency. During these years the gross agricultural income fell by 50 per cent, which was mostly because of the phenomenal fall in the prices of agricultural products.

This led to the mortgaging of the farms. It has been estimated that in 1931, 33.33 per cent of the total number of Canadian farms were

* The International Review of Agriculture.

burdened to the extent of 671,776,500 dollars which then represented 16.75 per cent of the total value of all farms and 40.86 per cent of the value of the mortgaged farms. In addition to this there exists a large number of short term debts which are usually incurred in carrying on the current operations of agriculture.

The measures adopted.—An act to facilitate compromises and arrangements between farmers and their creditors was assented to on 3rd July 1934 and came into force from the 1st September of the same year.

Under the terms of this law Official Receivers were appointed in each judicial district, and a committee for revision of debts was formed in each Province. A farmer who, without having become bankrupt, was burdened with debts which it was impossible for him to pay completely could go to the Official Receiver of his district, who would help him to draw up a declaration, showing the whole of the liabilities and estimating the whole of his assets. The farmer could then make a proposal suggesting either a reduction of his debts or an extention of the period of repayment. The Official Receiver then undertook to submit this proposal to the creditors. If they accepted it the arrangement became compulsory and was registered in the country court. If no arrangement could be brought about between the farmer and his creditors the question could be brought before the Commission of revision, consisting of a Judge as Chairman and of two other Commissions. The Commission has full power to conclude an arrangement involving both the secured and debts unsecured and this arrangement is final and compulsory.

Up to October 1935, nearly 90,000 farmers applied to the Official Receivers for information, and about 16,000 presented concrete proposals for the settlement of their debts. Out of this 10,625 farmers arrived at definite agreement. The proposals submitted involved a total indebtedness exceeding 70,000,000 dollars. The reductions made on this sum as a result of the meetings of creditors and of the decisions of the Board of Review amounted to about 12,000,000 dollars.

With the same object of relieving the farmers, the Farm Loans Laws have been amended so as to increase the total amount that can be lent by the Dominion Farm Loan Board from 75,000,000 dollars to 40,000,000 dollars and to raise the sum that can be advanced to any borrower from 50% of the

value of the security to 60% with a maximum of 7,500. The Board has also the right to grant loans on second mortgage with the object of enabling a farmer to resume his work.

The new legislation also prescribes that the farmers can completely redeem the mortgages at any moment (with remission of interest for three months) and that if the creditor refuses to accept the repayment the interest will automatically be reduced to 5 per cent.

UNITED STATES

American agriculture received a great impetus during the war owing to the fact that the North American Continent was called upon to supply the belligerent countries with food stuffs and textile fibres. This sudden large demand for products required the clearing and transformation of large areas of uncultivated land or pasture land. This fact encouraged by the continuous rise in the price of products, brought about an active movement in the purchase of land by farmers at the high price that then prevailed. This was made possible by having recourse to a large extent of credit. This resulted in very heavy indebtedness, which became quite unbearable as soon as the boom period was gone and the prices contracted. In fact after 1920 as the gradual restoration of agriculture in Europe led to a fall in the demand for external products considerable stocks began to accumulate in the U. S. A, and a disastrous fall in the prices followed. As prices remained for a number of years at unremunerative levels, many farmers became bankrupt, and almost the whole of the agricultural industry fell into a state of distress on account of the impossibility in which the farmer found himself in meeting the mortgage engagements entered into in 1920 when the price level was the highest in the present century. It is interesting to note how the agricultural income fell gradually after the year 1920. In 1919 it was 18% of the national income, and in 1921 it was reduced to 11% in 1928 it came to 9.3% while in 1932 it fell as low as 7% of the total national income.

Agricultural mortgage indebtedness was estimated in 1932 at about 8,500,000,000, dollars the total agricultural debt being probably 12,000,000,000, dollars this latter sum being even higher than the farm income of the year.

The measures adopted.—A central administration body, called the Farm Credit Administration, was formed in May 1933 to tackle the problem of indebtedness. Two tasks were assigned to this body. The first was the creation of a system of completely unified credit institutions

on a permanent basis to supply to farmers and farmer's organizations credit adopted to their special needs at the lowest cost compatible with sound business practice. The second task was the emergency financing necessary to meet the credit crisis resulting from the general economic depression. The aim of this financing was to facilitate the adjustment of the excessively burdensome farm mortgage debt and to reduce the rates of interest.

The importance of the refinancing carried out since the establishment of the farm credit administration is shown by the fact that during 1933-34 the Federal Land Banks and the Land Bank Commissioner granted S 575,849 loans to a total amount of 1,494,454,231 dollars.

Many applicants were indebted beyond the maximum allowed by law. In order to enable them to obtain the maximum of the new loans, it was often necessary for the creditors to relinquish part of the principal owing to them. These reductions amounted to more than one fourth of the indebtedness of the farmers who obtained these adjustment.

A second phase of the plan of refinancing relates to the reduction of interest charges on farm mortgages. Farmers who were already indebted to Land Banks obtained the benefit of the emergency reduction of the rates of interest. The new loans were also given at reduced rates.

The reduction of the interest had the effect of reducing the proportion of the gross income that was absorbed by the fixed charges. It is estimated that much of the interest that had to be paid previously has now been saved, as a result of the reduction of the rates of interest.

In addition to the reductions of interest, provision was also made for the deferment of the payment of the portion of the instalments representing principal on loans outstanding on 12th May 1933 or granted during the two following years provided, the loan is otherwise in good standing. Apart from the benefits obtained through interest reductions, the making available of credit in itself had far-reaching effects, the most important of which was, perhaps, that of reducing the number of distressed farms and facilitating their withdrawal from the real estate market.

From 1934 onwards there has been a general improvement in the economic conditions of Agriculture in the United States. This had also a favourable effect on the credit conditions of the farmers. This may be indicated by the reduction in the number of bankruptcies amongst

farmers; so also the number of applications for the special refinancing of farm debts fell almost continuously.

ARGENTINA

The nature of the problem.—The economy of the Agrentine Republic, which is mainly based on cereals and live-stocks, strongly felt the effects of the fall in prices on the World Markets. Internal prices, according to the general index-number of the prices of the principal export products showed at the end of 1933, a fall of 33% as compared with average level of 1929. In most of the cases the prices were not sufficient to cover the cost of production consequently the farmers could not pay their debts and were compelled to restrict their purchases. This affected the other classes of the republic as well. This led to a general reduction of the standards of life of the people.

Another characteristic feature of the crisis was the plight of the agricultural labourers. Every farmer now tried hard to become self sufficient by employing the maximum energy of his own family members, thus eliminating the expenses over the hired labour.

The fall of the prices below the cost of production level, made the farmers more and more indebted. For, the general practice is that part of the proceeds from the sale of the produce is firstly, paid to the banker as repayment of his loan and the interest thereon, and the remaining portion is left with the farmer for his own consumption and saving. But under the new circumstances the farmer could hardly get anything more than what he actually required to maintain himself and his family, while nothing was left which could be paid to the Banker. Money remained unpaid and the debts began to assume very large proportions. In 1931-32 many of the farmers had thought of abandoning their farms, which had become quite unremunerative.

The Measures adopted.—The above situation caused considerable anxiety to the public authorities, who then originated a vast plan of economic action with the object of meeting the crisis, from which the country suffered.

The plan embodies a policy of economic adjustments and of moderate intervention of the State in the Economic System.

For improving the credit conditions of the rural population the most effective measure was the authorisation given in 1933 by the Government to the Bank of the Argentine Nation, to grant loans through the medium of its agricultural credit section, in order to encourage agriculture, stock-breeding and rural industries, such loans being secured by the pledge of of the agricultural product already havested or still standing.

In addition to the above measure two laws were passed.

By the first of these laws, the commission of 1% charged on loan transactions by the National Bank was suspended for a period of three years, for the benefit of those debtors who regularly fulfill their engagements. During the same period, the debtors of the said Bank were not required to pay the half-yearly instalments of ½% fixed for the amortisation of their loan. The management of the Bank was authorised to conclude agreements with its debtors for the payment of arrears and to allow in this case, periods of repayment not exceeding ten years. The Bank can wait three years, after foreclosure on a mortgaged property, before proceeding to the final liquidation of the loan transaction. Up to the moment of the final liquidation, the debtor has the facility of redeeming his property by paying off the debt. The Government was authorised to pay a sum of 30,000,000 pesos m/n in internal public debt bonds to the Bank, which must provide for the payment of interest and amortisation on the bonds utilized.

JAPAN

The nature of the Problem.—In contrast to the high degree of prosperity attained in recent years by Japanese industry, which has been able to overcome unfavourable economic conditions by a remarkable adaptation of its capacities and its possibilities of world economy, agriculture has remained in the same state of distress in which it has been for some years in the past; not with standing the active policy pursued by Government with a view to remedying its state of disequilibrium.

There exist profound, and long-standing causes of this distress. Amongst the main causes may be noted the relative insufficiency of the culturable and the consequent pressure of the population on land. 71 per cent of the peasant families have at their disposal less than a Hectare of land (1 Hectare-approximately 2½ acres) and even allowing for the

low standard of life in Japan a Hactare does not suffice to produce what is indispensable to a family. The smallness of the cultivated area and the poverty of the cultivators involve in their turn, the almost complete absence of modern technical equipment. Further, in the majority of cases, the Japanese cultivator has to bear the burden of the rent which he has to pay to the landlord, because only 31 per cent of the cultivators are the owners of the land they cultivate.

To add to the misery that was already intense owing to the above mentioned drawbacks inherent in the Japanese Agriculture, the world economic crisis came with a full swing sweeping down the prices of cocoons, raw silk, and rice, the three major products of Japan. The period from the year 1929 to 1933 is characterized by a steady decline of prices, the average prices being lower than the cost of production level.

All the above circumstances resulted in increasing the indebtedness of the farmers to a very great extent. According to a recent enquiry made by the Ministry of Agriculture, and Forests, the indebtedness of the farmers amounted to 4,717,424,557 Yen, the average per farm being 837 Yen.

The general rate of interest is from 10 to 15 per cent.

The measures adopted.—The difficult situation in which the farmers of Japan found themselves gave rise to several measures, the most successful being, the founding of the Associations for the adjustment of rural indebtedness. (fusai seiri kumiai). These Associations aim at adjusting the indebtedness of persons residing in the Agricultural villages, by carrying out the adjustment of the debts of their members by plans for amortisation, and by plans for the revival of economic condition of the members.

These Associations are run with spirit of mutual solidarity and neighbourliness, which is identical with the principle of co-operation.

The working of the Associations is as follows:—

The Association in the first instance intervenes between the indebted member and his creditors, with a view to bring them to an agreement involving a reduction of the principal and of the rate of interest, and the granting of more favourable terms regarding the period and terms of amortisation.

When the good offices of the Association do not lead to an understanding, the Association can request the intervention of the communal committee for the adjustment of indebtedness; and if an agreement is not reached even by these means, the parties are authorized to avail themselves of the special enactment which forces the dissentiant party to agree to a reasonable plan of conciliation.

The second law laid down that those mortgages which become due after this law came into force, were to be postponed for a period of three years, provided that the debtor is not in arrears either of interest or of the principal for the two years. The maximum for the rate of interest that can be demanded during the period of the application of the law is 9% per annum.

A new law is now being drafted which aims at the final liquidation of many impossible financial situations, which for a long time past have fallen into the economic absurdity of an income that is not even sufficient to cover the interest of the debt.

AUSTRALIA

The nature of the problem.—The situation of the wheat growers in Australia has become extremely critical in recent years on account of their indebtedness.

Their situation was made clear by the Royal Commission on Wheat, Flour, and Bread industries. They number more than 70,000 and most of them look to wheat growing as their principal source of income. In 1933 their total debts amounted to about 150 Million Pounds sterling and since then they have considerably increased.

The commission pointed out that those who can pay their farming expenses and the interest on their debts when the price of wheat is not less than 3 S per bushel are 40% of the total wheat producers, those who only succeed in paying a part of their expenses and of their debts are 26% and those who cannot produce at this price, even if they are entirely relieved of their debts are 34%.

The total indebtedness at the time of the publication of the Report exceeded by £, 15,000,000 the total assets of the wheat growers.

Wheat growing in Australia requires a somewhat large capital, which for the most part is borrowed. It is generally difficult to pay back this

sum with interest. Unless the farmer conducts the production with great economy and combines wheat growing with sheep farming or other accessory forms of production, during the years preceding bad years. As for the others, their borrowed debts go on increasing year by year by the addition of interest which they have no means to pay when it becomes due.

As regards the adjustment of debts, the Commission recommended that procedure should be adopted whereby voluntary arrangements between creditors and debtors could be facilitated. For this purpose, Debt Adjustment Courts were to be formed, presided over by a judge, and assisted by qualified advisers. These courts could decide case by case whether the farmer in question deserves to be assisted or not. All the wheat growers who showed a reasonable chance of again becoming prosperous and were in need of assistance were to be assured of national aid, subject to the efficient conduct of their business; but if the court decided that there was no reasonable probability that the farmer would be able to produce wheat at a normal net cost, or that he did not seem to be in satisfactory condition, or for other reasons, then he was not to benefit by the protection of of special legislation. It was proposed that this plan should continue for 7 years.

The Credit (Adjustment of Agricultural Debts) Act of 13th April 1935 laid down that a sum not exceeding £. 12,000,000 could be borrowed, and that the proceeds of this loan could be granted to the States to be utilized in making payments to the farmers or on their behalf, in order to enable them to make voluntary arrangements with their creditors.

BRAZIL

The Brazil Government took a drastic step by issuing a decree on the 1st December 1933 which has the effect of step reducing all the debts of the farmers contracted before 30th June 1933 on the security of real prosperity, and also all debts contracted after that date in order to renew previous debts, this reduction also applied to the cases of debtors of the banks when they are found in a state of insolvency. In order that creditors should not suffer any loss, the Government indemnified them by the issue, up to a total amount of 500,000 contos of reis, of bonds of the nominal value of 1 conto of reis exempt from taxes, bearing interest at 5% per annum and repayble within a period of 30 years. While the

debts were lightened by the above mentioned method, attention was also paid to the necessity of providing them with finance in order to meet their current requirements, lest they may again contract debts on burdensome conditions from private individuals. An Agricultural Credit Section was therefore started at the Bank of Brazil. This section obtained the capital required for its working by the issue on the national market of bonds redeemable at a fixed rate negotiable on the Stock Exchange.

The Agricultural Credit Section grants to farmers and co-operative societies, loans for the purchase of seed, fertilizers, agricultural machinery, breeding stock, for harvesting the crops etc. The loans are to be repaid after 12 months. The amount of the loan does not exceed one third of the estimated value of the crop to be produced. In case of bad harvest due to natural calamities the Agricultural Credit Section postpones the date of repayment.

A TOUR TO SOME OF THE IMPORTANT PLACES IN MAHARASHTRA

M. V. Gokhale, Junior, B. Ag.

Introduction.—During the last summer vacation I and my younger brother decided to visit places of industrial and agricultural importance in Maharashtra. We also visited places of historical importance and spots of nature's beauty. We made Poona as our head-quarter and arranged short trips from there. The following is a short description of our tour.

Poona.—The main object of our visit to Poona was to see the Swadeshi Industrial Exhibition. Leaving Bombay, Poona is the most important city of the Maharashtra and is a big centre of education. Such exhibitions are often held there. The credit of this year's successful exhibition is largely due to Mr. B. V. Gharpure, Curator of the Reay Industrial Museum, Poona. The agricultural section of it was particularly very interesting.

Fruits Section.—Among the countless exhibits, were the grafts of Neelam mango, guavas, lemons, chikus and papayas of Washington type. Various methods of preserving fruits were demonstrated. Machines which extracted lemon juice and bottled it were shown. It is noteworthy that these machines are made in India and are very cheap and efficient. Jelly made from guava and bottles filled with tomato juice were shown to us. They have also constructed a machine which extracts the

essential oils from the rind of the fruits of lemon and orange. Drinks (sharbats) made from lemon and orange were also kept. We also tasted fine grapes which were brought fresh from the Ganeshkind garden near Poona. The tract round about Poona grows a large quantity of fruits like figs, mosambi and chiku. It is a very serious question facing these fruit growers how to preserve these fruits that are sold at amazingly low prices in the season. An experimetal station is also established at the above mentioned Ganeshkhind Gardens in order to try and preserve various varieties of fruits.

Dairy section.—A number of charts were kept which campared the value of a quart of milk with some other foods. Instructions were given regarding the proper methods of preserving milk and its products. It was emphasized that milk should be heated by keeping it in a pot surrounded by water and then heating the outer pot. The differences between the milk from different animals and the methods of humanising cow's milk for children was explained. The separation of cream from milk, the making of various products and the methods of testing milk for adulteration were demonstrated.

Poultry section.—The different types of fowls and their eggs were arranged for show and their comparison with the country fowl was made. Profitable ways of feeding and housing the poultry and the use of an incubator were demonstrated.

Land improvement section.—Small models of fields, one with bunds and the other without bunds, were kept. The one without bunds showed how the land is spoiled by the washing away of the silt by means of torrents. The other, with proper arrangement of bunds, saved the finer soil, maintained its level and conserved water.

Irrigation department.—This was a very interesting section as it showed the Western Ghats and the irrigation projects by means of neat models. The area irrigated by the rivers in the Maharashtra and the crops grown were shown in the maps.

Co-operative department.—It insisted upon the importance of co-operation in villages especially for the supply of pure water for drinking, for protection from boars and the improvement of the village by sanitary arrangement of houses.

Forest section.—All the things in this section were made from the wood from the Bombay forests. Things made from sandal wood were very artistic and were sold on large scale.

General section.—The processes of ghur making, seeds of various types, sprays, dusting guns, different types of insect pests and the bulletins published by the Agricultural Department, Bombay, were kept for general information.

Besides Agriculture, the exhibition included almost all Indian industries. Iron ploughs, biscuits, soaps, cloth, pipes, oil-engines, glass work, enamel work, medicines and paper are some of the large number of things that were represented there. On the whole, the exhibition was very instructive and was a sure mark of India's steady progress in the sphere of industries.

After seeing the exhibition, we turned our attention towards other institutes in Poona, important from our point of view. Of these, the College of Agriculture was the most outstanding. With the help of Mr. Sakharam Naik, a B. Ag. of the college, we were able to see the institution and the farm in detail. The college building and the hostels are spacious. The course is of three years after passing the First year examination of the Bombay University which is common for all the courses. After each year there is the University examination. The rule about the wearing of the unifrom is strictly observed even in theory classes. The degree is now changed fram B. Ag. to B. Sc. (Ag). A poultry farm and a Meteorological section is attached to the college. On the whole, the college is very well equipped.

The Meteorological Observatory, Poona.—This is the head office of the department and is open on every Wednesday for the people to see. The arrangements for explaining things are adequate. Some member of the staff takes the visitors round and shows the instruments which automatically record temperature, rainfall, the direction and speed of the wind, heat of the Sun and the way in which charts are prepared daily. All the instruments are first tested here and then sent to other observatories in India. From time to time balloons are sent up, inside which automatic recorders are placed and thus more information about the atmosphere is obtained.

Lord Reay Industrial Museum.—It is situated in the centre of the town and has got specimens representing almost all industries.

Sathe Brother's Biscuit Works.—This is a fairly large biscuit manufacturing company as compared to other Indian concerns. All the work is done by means of machinery excepting sorting and packing which is done by hand. This sight is not very pleasing to look at. The biscuits are quite nice and are popular. It is really gratifying to see Indian Manufacturers stepping into such new sphere.

Poona has got a Paper Mill and there are several beautiful gardens. Along with three arts colleges, Poona has got an Engineering College and a Medical School. The Women's University is at Hingne, very near to Poona. The University shows what a single industrious man can do. It is the only one of its kind in India and is the fruit of the most enthusiastic efforts of Mr. D. K. Karve, who is now 79 years old.

While at Poona, we interviewed Mr. S. R. Bhagwat, L. C. E, Chief officer of the Poona Municipality. He is an active worker in the cause of village uplift. We arranged with him the programme of our trip to Bhade, a village-uplift-centre about 36 miles from Poona in Bhor State. He usually goes there on every Saturday and comes back on Sunday. A number of friends and admirers of the work also accompany him there.

We gathered the following information about the village Bhade.

Height of the Place—1930 ft.	Population—1450.
Average temperature—75 Ft.	Male—454.
Average rainfall—15″	Female 479.
Extensive farming 1150 acres	Below 18 years—517.
Intensive farming 500 acres.	Literate 520.
Pastures 3210 acres.	Illiterate 930.
Small dams 6.—Irrigate 300 acres.	Animals 2850.
Wells 45—Irrigate 200 acres.	Bullocks 306.
Juar, Bajra, Safflower 1300	Cows 205. Buffaloes 39.
Wheat and gram 50	Sheep 1600.
Onion 100 acres and sweet potato 50 acres.	Goats 600.
Chillies 150 acres.	

Mr. Bhagwat told us how a colony came to be established at Bhade. Some years ago, onion was the chief money crop and there existed many well-to-do families in Bhade. As in other villages, there were some enthusiastic public workers in this village too. As long as people had money with them, these social workers did not find any difficulty in their

activities. As a proof of this, they showed us a channel, about 5 miles long, dug entirely with the co-operation of the villagers, for irrigating their lands.

After some days the prices of onion went down and people did not have sufficient money with them. As a result of this the young men were no more encouraged. The figures for the year 1934 show that the village sent Rs. 2500/- outside while Rs. 2000/- were received. Under such condition the leaders of the young party went to Mr. Bhagwat, who is the secretary of the Rural Reconstruction Association, Poona, for advice in the matter. He encouraged them and afterwards these were the men who took the lead in founding the Pioneer Colony, Bhade.

The pioneers wish to make widely known the facts that are inspiring them, and the plan they propose to carry out, being confident that making them known will bring others to work with them and help to give the effective demonstrations that are now needed. They have facilities to offer for people joining them in the pioneering work they are planning in villages near Poona.

The special idea is educational colonies co-operating with their neighbours. They might then obtain their foodstuffs not by farming themselves, but by co-operating with the cultivators. They will help the cultivators in all matters and take a share of produce for their payment. About fifty families will be given different kinds of work relating to Agriculture. They will be engaged in agriculture, dairying, poultry-farming, and sheep-breeding as main industries. At present there are fourteen families.

We were very glad to see that some solid work was being done for the betterment of the Indian villages. On our way back to Poona we visited the Vir dam across the Nira river. Then we saw the Bhatghar dam, also known as the Lloyd dam. It is situated in the Bhor state and is one of the largest dams in the world. Its height is 190 feet and the length is 5333 feet. It holds about $21\frac{1}{2}$ million cubic feet of water and its construction cost about 172 lakhs of rupees.

The next item of our programme at Poona was to see the famous historical fort Sinhagad. It is about 15 miles from Poona and in summer, there is a regular motor service because it is used as a summer resort. The climate is cool and dry and the water has got medicinal properties.

We reached there early in the morning and began to climb the fort. It is a bit steeper than the Daulatabad fort. It is about 4300 feet above the sea-level. When we reached the top and threw a glance at those vertical cliffs, we had an idea of how hardy the followers of Shivaji, The Great, must have been who climbed those cliffs. Along with other remains, there are the Samadhis of Tanaji and Udaybhanu and a chhatri of Rajaram. The water of Dev tank is very cool and refreshing. The View of the Mutha river is very picturesque. On the whole Sinhagad is not a busy place like Matheran or Lonavla but has got its characteristic calm atmosphere. We spent the day there and returned to Poona in the evening, visiting the Khadakvasla dam on our way back.

We had practically finished our programme at Poona and decided to go to Belapur because in the case of delay, the factory was likely to get closed. On our way to Belapur, we halted for a day at Dhond which is the wireless receiving station for the whole of India. The spot was selected for the purpose because the area round about is very dry and devoid of mountains for miles. One of the engineers there happened to be our relation and he was kind enough to explain the various instruments and their working in the most simple and intelligible manner.

The colony is a happy collection of men of all castes and creeds. They have got a number of boring wells and a small vegetable garden. They also run a School, a Club and a Co-operative Store.

Belapur.—On the 22nd of April we reached Belapur. This is a station on the Dhond—Manmad Section of the G. I. P. Rly. From the station Harigaon, the estate is about 6 miles distant. There is a regular motor service, between Belapur station and Harigaon. We put up with Mr. G. R. Mahajan, B. Ag., who is Estate-Manager there. He is one of the authorities on Sugar industry in Maharashtra. With his kind help we could see the estate and the factory in close details.

The company owns an estate of about 12,000 acres. It grows much of the sugarcane that is required by it. For the convenience of management the estate is divided into circles. These are further sub-divided into 'wadies.' There is a regular staff at each wadi. Motorable roads run all over the estate. It was decided that we should see one wadi in details and then have the general view of the estate. Accordingly we visited wadi No :—1. From there Mr. Kharkar, B. Ag., from the Poona college, accompanied us. As he was the overseer there, he knew the ins

and outs of the wadi. It was really a grand view to see green fields of sugar-cane stretching away to the horizon.

The chief varieties grown there are P O J 2878, CO 290, CO 419, Ek. 28. The CO varieties are good ratooners and therefore they were cut once and allowed to grow again. They also plant cane in June, which is out of season and is called Adsali. This helps them to run the factory continuously for a longer time as the cane from Adsali is got even after the true season is over.

As we proceeded, we saw the land being ploughed by the "Steam Tackle Plough." This is used when the land is very uneven and where tractors cannot work. Two machines, resembling road-rollers were placed at the two ends of a vast field. A big plough with many shares is worked in the fields by means of a cable which is wound over a drum of one machine while it goes on unwinding from the other machine. The process is done alternately by both of them. When a set of lines is ploughed, the machines advance a little to take up the new piece of land for ploughing. The fertilisers applied were some cheap cake and amonium sulphate. We found that the doses were not uniform in all the wadies. Ploughing, manuring and harvesting were going on in the different parts of the estate. The irrigation water is supplied from the canals.

In the after-noon we went to have a view of the whole estate. We saw an implement called The "Gyro tiller" working in the fields. We were told that it was worth a lakh of rupees. It was something like a huge tractor with a large wheel attached behind. The wheel rotated and its blades stirred the soil up to the depth of a foot or so. This rotary plough did about 10 acres a day.

The cane is brought on trollies from all over the estate. It is first weighed and then unloaded directly on an endless chain which takes it high up to the crushing machinery. It is twice crushed between three rollers and the process is repeated. Hot water is sprayed on the crushed cane and it is again crushed to extract everything out of it. The megasse is used as fuel.

The juice is purified and it is evaporated to a syrup. This juice is still evaporated and we get what is known as massecuite which contains about 45 per cent water. The work of taking away this water and of

forming crystals of sugar requires a lot of skill and labour. This is done in the vacuum pans. Two grades of sugar are produced in this factory.

The company has got a chemical laboratory of its own where the products are analysed daily and the observations are recorded for guidance. They have also maintained a museum in which all the varieties that they tried from the beginning, are placed. The milk that is required by the colony is produced there in a small dairy.

This trip was one of the most interesting programmes of our tour and our heartfelt thanks are due to Mr. G. R. Mahajan under whose guidance the factory is prospering.

Verul.—From Belapur we proceeded to Aurangabad via Manmad. Aurangabad was founded by the Mogul Emperor Aurangazeb. At Aurangabad there is a very beautiful tomb of his queen. It is built in the same fashion as the Tajmahal. The tomb of Aurangazeb is at Khuldabad on the way to Verul. We hired a tonga and went to Daulatabad. The fort is an ancient one and was the cause of many epoch-making battles. At the foot of the fort, there is a lofty tower. The sides of the hill are vertical and there is a deep ditch round it. The fort is not very high and there is a fairly good passage. Sometimes we have to pass through utter darkness and a guide is appointed to show the way. For a foreigner the passage is dangerous too; because there are many false passages meant to mislead the enemy and to send him directly to the ditch. On the top there is a building called Baradwari and also the Samadhi of Janardhan Swami. There are many large and old guns.

After seeing the Fort we proceeded to Verul, which is wrongly pronounced by foreign travellers as Ellora. The caves have been carved in the mountains by Brahmins, Buddhas and Jains. There are about 35 in number. The hall of Vishvakarma is very beautiful and contains an image about 15 feet in height. There is a cave which is tnree-storeyed and hundreds of men can sit in it at ease. The Kailasa cave is like a very big temple of Mahadeo, carved out of a single rock. It is the best and the most beautiful of all the caves. We returned from there, wondering at the skill and perserverence of those who labouriously carved these caves.

From Verul we returned to Poona and after a short rest started for Kirloskarwadi. It is a station on the M. S. M. Railway and is 136 miles

from Poona. Before entering the town we saw the marble statue of the mother of Mr. L. K. Kirloskar, the founder of the wadi. The town is well laid out and the roads are straight, wide and metalled. Electric light are provided. The water supply is good. The guest house is really an ideal one.

All possible facilities are provided by the company for visitors. First of all we visited their office and saw Mr. Gurjar, who is the manager. He gave a man from the publicity department to show us the works. They have got a power-house of their own. All the different parts of the wadi are connected to the office by means of telephone. When we went to the moulding shed we saw different moulds being prepared for the melted iron to be poured into. Unlike other factories, there are wide passages between the different machines and thus there is very little possibility of accidents. The workers on the whole were healthy, jolly and efficient. They gave us a lot of information in simple language.

One machine was seen sawing off big bars of iron, while another was punching holes in a thick sheet of iron. A mechanical hammer was giving a particular shape to the plough shares. Rahat, sugar cane crushing mills, ploughs, ground-nut-shellers and a number of other machines and implements were being manufactured. They also make house-hold furniture and recently they have been successful in making a cheap and efficient operation table. About 800 workers work there daily.

The position of the wadi is not well suited to the work it under takes. Iron and coal are to be brought from Jamshetpur and crude iron from Mysore. Immense amount of freight is to be paid for importing these and exporting the finished products.

After seeing Kirloskar-wadi, we went to see Ogalewadi which is about 22 miles from there. Ogalewadi is famous for the manufacture of hurricane chimneys and other glass articles. They manufacture globes, plates, tiles, tumblers, shades for electric lights and such other things which we use in our daily life. The crucibles required for the melting of glass are made here. The iron sheets are purhased from the Tata iron works, They prepare enamel boards and unbreakable slates. Utensils are made from a mixed metal called Ever-silver. They also run the Aundh soap works where both toilet and washing soaps are made. Both these wadis are objects of great pride to Maharashtra and India.

Kolhapur.—After seeing Kirloskarwadi we proceeded to Kolhapur, with a view to see a Maratha state. It is the capital of the state of the same name and is a fairly large town. It is connected to Miraj by a railway line. As our train approached Kolhapur we found a number of orchards and gardens on both the sides of the line. Cultivators were seen doing the summer cultivation by means of heavy Kirloskar ploughs using three or four pairs of bullocks. We noted that in some fields small heaps of katchera were made and burnt.

Kolhapur has many lodging and boarding houses. As the Maharaja had gone to Shivapuri for hunting, we got the opportunity of seeing his palaces. We congratulated ourselves upon this and obtained the necessary permission from the private secretary of the Maharaja. On our way to the palaces we saw a big tank named Rankala. The Shalini palace, named after the princess, attracted our attention from a distance. It has got a charming and well-arranged garden round it. The rooms and halls inside were nicely decorated by means of beautiful paintings, photographs, and things wrought in gold and silver. The rooms were painted with different colours. One room from floor to the ceiling was pink in colour. Even the curtains, furniture and other things were of the same colour. Similarly, the other was faint blue, the third was green and so on.

Having seen this palace, we went to see the Maharaja's palace. Though this was not very artistic, it was certainly grand in appearance. It had a magnificent Darbar-Hall with a golden throne of the Maharaja. In its show-room hundreds of animals, hunted by the Maharaja were kept stuffed. It was really a marvellous sight to see numerous cruel and wild faces glaring at us from the walls and the cupboards. The Maharaja is also very famous for his love for horse racing. He owns hundreds of fine horses and has won numerous trophies in racing.

Kolhapur possesses some of the finest studios but we could not visit these because the time at our disposal was very short.

After our visit to Kolhapur, we decided to go to some places of nature's beauty. The Gokak falls attracted our attention as we had heard much about them. Accordingly we came back to Miraj and changed for Gokak. Before the train reached Gokak Road, we saw a dam built across the Ghataprabha river. Afterwards we knew that it was built in order to supply water in summer to the turbines which generate electricity for the Gokak Mills. The fall is some four miles from the

station and the town is four miles further still. There is a regular motor service.

The current of the river was thin but there was considerable force in it. Even in those days the tract around the falls was green and appeared as an oasis in the desert. First of all, we visited some very old temples that were nearby. They were of God Mahadeva and were built in a fashion which is not common in the northern tracts. Here we tried to talk with some of the local people and they too answered us but none of us understood each other. Thus we came to know that we had left Maharashtra and were on the Northern border of Karnatic. However the shop-keepers and station masters understood some Hindi and we did not find much difficulty.

Then we went to see the suspension bridge which is built by means of cables across the river. When we walked over it the whole bridge began to shake and we felt as if it was collapsing. It was a novel experience for us. As we got down we had a comfortable bath in the cool water of the river. The river jumps down from a great height. Water gets so finely divided that it appears as if ginned cotton were falling down. It was here that we felt the absence of a camera most. It was difficult for us to leave the charming place, but it was getting dark and we had to reach the station in time.

The mill is run by means of electricity generated with the help of the water of Ghataprabha.

On our way back to Poona, we visited Kooper's Hindustan Engineering works at Satara Road. They are similar to the Kirloskars but not so well-equipped. On our way back from Poona we decided to visit Lonavla, which is one of the finest health-resorts of the Bombay Presidency. It is about forty miles from Poona. Lonavla is about 1800 feet above sea-level. In summer, it is neither very hot in the noon nor very cold at night. On the whole, the climate is very healthy and refreshing. We were very glad to spend a couple of days there after such a busy and extensive tour for about a month. We reached Lonavla on the 9th of May. The first item of our programme was to visit the Karla caves which are about six miles away. Motors go upto the foot of the hill. For the old people and the weak there is an arrangement of dolies which are

chairs carried by the coolies on their shoulders. The hill is not ver high and the road is quite comfortable. The visitors are required to pay a tax of As 2 per head before entering the caves.

The caves here, except one, are quite ordinary and no special art is seen. The one in the centre is very capacious and contains some pieces of fine art. Some of the carvings are badly mutilated. The base of a huge pillar has given way and the upper part is hanging like a stalactite and is likely to fall at any time. The caves were carved mostly by the Buddhists. There is also a Hindu temple and to our utter surprise, some people were seen sacrificing goats and fowls to God, while an image of Buddha, the greatest preacher of Ahimsa, was looking at them with eyes wide open.

Next morning we went to see the Walwan lake which supplies water to the Tata Hydro Electric works at Khopoli. In the evening we visited Khandala, which is about 10 miles from there. Khandala is situated among beautiful hills. Unlike the hills round about Poona, these are covered with jungle and there were some streams with pretty water-falls. We saw the power house at Khandala. There are some very fine points. The electric trains moving in the valleys resemble serpents moving very slowly. One of the peaks is called "The Duke's Nose" because it resembles the nose of the Duke of Wellington.

On the 12th of May, we had to leave Lonavla, despite our attraction for such a lovely place, because we wanted to see Bombay, with its Coronation illuminations.

When we reached Bombay, we felt as if we had left the colder regions and gone into the tropics. The climate was very hot and humid. In the evening, we started in a tram car which passed through the heart of the city and took us to seaside. There was such a great rush that we had to show sufficient skill and activeness in getting into the tram. The roads were so crowded that the tram took two hours to reach Apolo Bunder. Some towers and domes were lined with lights while others were floodlit with different colours. Some steamers were also illuminated and their reflections in the deep water of the sea were fascinating. We had a pleasant boating and saw the grand view of the city from the boat. After this we climbed the Malabar Hill and had a view of Bombay from the highest point. We returned late at night by a local train.

We visited the Victoria gardens and the Prince of Wales museum which possess some of the finest and rarest specimens of animals. The historical section of the museum is very interesting and instructive.

There are a number of things in Bombay, which, if described in details, would form a separate contribution and therefore, these cannot be described here for want of space. In short, we travelled about 2700 mils. The expenses were Rs 50 per head, of which the railway fare amounted to nearly 40 rupees.

The tour has given us much practical experience, which it is hoped, will help us in our future enterprises.

COTTON MARKETS IN THE CENTRAL PROVINCES AND BERAR

J. P. Tiwari, B. Ag.

Prior to the middle of the Nineteenth Century, marketing of cotton was a simple problem in villages. It's transaction in all probability was largely carried on by barter and the nucleus of exchange was the village merchant who used to stock atleast all the necessities of the villages. It is said that the cultivators used to spin raw cotton into yarn for marketing. Whatsoever might have been the forms of its marketing, it is a fact that a cultivator had restricted scope for its disposal. The village merchant was the only person who effected sale of cotton and cotton goods. It may however be presumed that the raw cotton as such was rarely sent to remote destinations on commercial scale due to lack of proper transportation facilities.

The first known export of cotton from Berar is recorded to have been made sometime about 1825-1826. This enterprise was undertaken by a Bombay merchant and was executed on pack animals.

With the development of metalled roads, railways, telegraph and telephone, cotton cultivation passed beyond the stage of self sufficiency. It's production since then is undertaken on commercial basis. Business centres sprang up which received and disposed cotton and other farm products. Cotton cultivation received stimulus all the more on account

of cotton famine in Lancashire, caused by the American Civil War of 1862.

With the object of carrying on systematic business, cotton markets were instituted in Berar under private management. Lint was mostly marketed. Nominal taxes were collected on the transaction. Funds thus raised were utilised to meet the necessary expenditure for the management of the market. They functioned well for sometime. Later on, the entire responsibilities were willingly shouldered by the Municipalities in whose hands they worked smoothly up to 1897. Amongst such markets, Khamgaon is said to be the oldest one and is in existence since 1865.

Earlier than 1870, exported cotton used to be hand-ginned and loosely packed and lots of difficulties were experienced in it's handling and transport. The introduction of steam gins and presses metamorphosed the entire industry, with the result that cotton has gradually attained the foremost place in Indian trade.

Under Berar Cotton and Grain Market Law of 1897, Cotton markets are assigned to Cotton market Committees which are constituted under the Act. The source of income of the Committees are the assessment on the Kapas carts, bojas and bales. License fees are also charged to Adatyas, Brokers, Buyers and Weighmen. The Cess rates and fees vary in different markets.

Under this Law, the market limits are notified and Committees are elected to manage the affairs of the markets. The managing committee consists of five members. Two are the representatives of the local bodies such as Municipalities or District Councils and the remaining three are elected from the cotton dealers. The representation of the cotton dealers in the committee is mostly of the trading class while the growers find negligible or no representation. This can be attributed to the qualifications which are required of a candidate, who stands for election. Amongst these, the most important is that the candidate must purchase or sell not less than hundred bojas of ginned cotton or hundred Khandis of Kapas in a year. From the above condition, it is evident that an average grower cannot stand for election as it is beyond his possibilities to grow and sell a hundred khandis of cotton a year.

The objects, with which the markets are inaugurated are to provide better rates and to provide the villagers with proper shelter and other

facilities such as water, hotels, latrines and so on during their stay in the market. The malpractices, which are adopted by the traders during transaction of Kappas are largely due to deplorable illiteracy of the cultivators who repose implicit confidence in Adatyas and Brokers. As these commission agents act for the buyers also, it can certainly be assumed that they cannot sincerely serve the grower class. Discrepancies also occur due to non-observance of market laws and byelaws strictly.

As soon as Kapas carts reach within the limits of the market, growers have to engage Adatyas and Brokers because buyers are loath to deal directly with the sellers. The harmonious relations between buyers and commission agents are due to reciprocal benefits which one brings to the other as a result of mutual understanding. The growers have practically no voice in fixing the rate which is bid under cover. In case, he dares to meddle with or refuse to accept the rate offered, he is destined to find himself in a lamentable position. The decision of the Adatya prevails in all matters. In case of dispute, sub-committee usually lends support to the view point of the Adatya. The fact is that the members, of the committee, generally belong to the trading class.

Weighment of Kappas in Berar is either done on Beam-scales or Weigh-Bridges. It is not untrue to say that a seller is made to loose atleast 14 lbs of Kappas per Khandi in either of the devices. This is due to the attractive bribes which are offered to the weighmen by the buyers at the close of the season. If the aggregate loss of the growers in the whole province is considered, it may amount to a few lacs rupees annually.

In order to save the losses of the poor growers in these hard days, introduction of Weighbridges having automatic weight indicator is essential.

In the Central Provinces most of the Cotton Markets are still governed by local bodies under Municipal Act of 1922. No special committees are necessarily appointed to look after the affairs of the market. As the representation in the Municipal Committees and sub-committees is usually of the merchant class, it is seen that the interests of the growers are largely ignored.

With a view to provide better facilities and amenities to the growers and also eradicate the abuses which creep in the marketing of cotton, a

legislation was enacted in 1932 under C.P. Cotton Market Act. According to this law, separate cotton committees are established which function independently. They have no concern whatsoever with local bodies. Growers have fifty percent representation and the rest are represented by Municipalities, District Councils or Notified Area Committees and Cotton traders. This Committee has it's own jurisdiction and separate staff is maintained. Dharmadaya and other deductions are done away with. It is anticipated that various evils such as under weighment and reduction of weights in ginning factory, which do occur during the transaction, will be minimised. The funds are raised by assessment of Kapas carts, loose and pressed cotton. Fees are also levied on Adatyas, Brokers, Buyers and Weighmen.

Under this Act of 1932, up till now only two regulated cotton markets got established in the Central Provinces and Berar one at Warora and the other at Chanda.

Formation of C. P. Cotton Market Act of 1932 seems to be justified by one fact that inspite of four years having elapsed after the promulgation of the Act, no enthusiasm appears to have been exhibited by the local bodies regarding the establishment of cotton committees in their respective areas. There has been a tendency to evade the act as long as possible.

Having noticed the apathy of the Municipalities and similar institutions towards the support of the said Act, Provincial Legislative Council took the initiative in the interest of the cotton growers. A Law was formulated by the said council in 1936 under which Local Government is vested with the powers to establish cotton markets even without the consent of the local bodies concerned. The consequence of this legislation is that the Municipalities of Wardha and Hinganghat have voluntarily applied for the application of said Act in their respective towns. Others are also expected to follow their example.

C. P. Cotton Market Act of 1932 has one important advantage over Berar Cotton and Grain Market Act of 1897. It is the fifty percent representation of the Cotton growing class. Although it is too early to forecast anything about the result of this Act, still it is anticipated that the growers in general will be economically benefitted. It is likely that this Act may replace the Cotton and Grain Market Act of 1897 in Berar.

Rates of Kapas in local markets are based on quotations of fine Oomra in Bombay. Various methods are employed by the traders to convert Bombay price to local price of their respective markets.

GLOSSISTIS OR INFLAMATION OF THE TONGUE

S. K. Dighe, G. B. V. C.

Causes.—Feeding on rough coarse food, and mechanical and chemical injuries. It is also a complication in bad cases of Foot and Mouth disease when the case is neglected. Also in one form of Anthrax called "Gloss-anthrax" and another disease called Actinomycosis in which the tongue becomes so hard that it may be called "wooden tongue."

The mechanical injuries are due to the breakage of drenching bottles accidentally in the month while giving a drench to a vicious animal or receiving injuries to the tongue on account of rough borders of drenches such as tin can, horn, and bamboo.

Chemical injuries are due to administration of Chloral hydras, preparations of ammonia and turpentine improperly diluted.

The whole organ or a part of it is diseased. The terminations of these are induration, suppuration and gangrene.

Symptoms.—There are general signs of fever, profuse salivation, tongue becomes large and hangs out from the mouth, the animal goes off feed and there is also some interference with breathing, swallowing; and the mouth is kept partially in an open state.

Treatment.—Give laxatives as magsulph zvi or Soda sulph zvi with zi of sodium chloride and oii of water. Use gargles or mouth washes of lotions containing borax and alum or potash chloras with the strength of zi to oi of water with glycerine and honey ziv. If there is much swelling and redness, a few longitudinal incisions or scarifications here and there will reduce the swelling.

The animal should have always by its side a bucket full of water containing nitre or either Borax or Alum.

The animal should be given sloppy diet, milk, gruel or Kanji, and if the animal cannot eat its food, nutritive enema should be given.

When suppuration sets in the abscess must be opened. The part must be dressed antiseptically with Boric lotion or Condy's fluid; when gangrene sets in, the part generally sloughs off; if not it should be removed cautiously.

If there is extensive gangrene the animal generally dies of Septicemia or Pyaemia.

This disease should not be confounded with Gloss Anthrax and induration of tongue or scirrhus tongue, and should be distinguished from Actinomycosis.

CULTIVATION OF BRINJALS

B. S. Rao L. Ag. (*Hon*).

Vern. names.—Marathi—Vange, Hindi—Baingan.

Natural order.—Solanaceae.

Bot. Name.—Solanum Melongena.

The fruit of the Brinjal plant is one of the most important vegetables and the plant is commonly grown all over India.

There are several varieties varying in size, shape, and colour of the fruit. The fruits may be green, yellow, white, violet or streaked. They may be egg-shaped, long or globose. They may contain very few seeds or many seeds. Long seedless varieties are specially suited for the special preparation with rice known as Vangibhath. The red round variety is very popular for the preparation of ordinary Bhaji.

Propagation.—Propagation is from seeds. Seeds are collected from well developed fruits which are allowed to become completely ripe. When fruits are completely yellow, the seeds are taken out mixed with ashes and then dried.

Season.—Brinjals could be grown throughout the year, but on heavy soils in localities where the rains are very heavy the crop generally fails due to excess of moisture.

Nursery.—Seeds are first sown in properly prepared nursery. The nursery consists of raised beds if the seeds are sown during rains. During other seasons the nursery may consist of sunk beds. The soil should be rich so that the seedlings may grow quickly.

Seed rate.—To supply sufficient seedlings for planting an acre, 12 ozs of good seeds should be sown in 200 or 250 Sq. ft. Seeds can either be broadcast or sown in lines 2 inches apart.

Care of Seedlings.—If seeds have been sown too close some of the young plants should be removed to prevent crowding. In an overcrowded nursery the seedlings become weak and drawn out and fail to establish themselves when transplanted.

Ashes should be freely dusted over the seedlings to prevent the attacks of insects.

Transplantation.—seedlings are ready for transplantation within six weeks to two months from the date of sowing of the seeds.

A few hours before the seedlings are lifted the nursery should be watered so that the seedlings may be lifted with as little damage as possible to the roots. Each seedling should be lifted with some of the soil surrounding its roots.

Seedlings should be transplanted in the evening or in cloudy weather so that the seedlings may establish easily in the field.

Cultivation.—The land should be well cultivated. The land is ploughed deep once and harrowed twice.

Manuring.—30 cart loads (10 tons) of Farm yard manure are applied per acre as basal dressing.

Lay out.—On heavy soils planting is done on flat land in lines 2 feet apart. 18" to 2 ft. distance is maintained between plants in a row. The plants are earthed when sufficiently grown. On light lands furrows are opened 2 feet apart and planting done in the furrows. Spacing of 18" to 2 ft. is maintained between plants in the same row. It is advisable to plant only one seedling in each hole instead of 2 or 3 as is sometimes done.

Irrigation.—If transplanted during winter an irrigation should be given immediately after planting is over. The second irrigation should

be given after 4 or 5 days interval. Subsequent irrigations are given after intervals of 6 to 8 days; lighter soils require more frequent irrigations. Irrigations should be more frequent during hot weather than during cold weather.

Intercultivation.—The soil between plants should be kept free from weeds and well mulched by working with Khurpi once a fortnight till the plants are earthed up.

Top dressing.—A tola of either sodium Nitrate or Ammonium Sulphate or a handful of cake may be applied to each plant a month after transplantation.

All plants that die due to any reason should be uprooted and burnt.

Harvesting.—Seeds are sown, say, in May. Transplantation is done in July. The crop begins to bear in October and continues to bear till the end of the cold season. Fruits are plucked after every 4 or 5 days.

Yield.—A good crop yields six to seven thousand lbs. of Brinjals.

Labour required for some of the Operations.

PER ACRE

Operation.	Men	Women	Pairs of bullocks	No. of days.
1. Preparation of 250 Sq. Ft. nursery.	3	Nil	Nil	3 days.
2. Watering the nursery and tending seedings.	Nil	1	Nil	4 hours a day for 2 months.
3. Ploughing the land with a heavy inversion plough.	3	Nil	2	3 days each time
4. Bakharing.	1	Nil	1	½ each time.
5. Marking lines 2 feet apart with a special line marker.	1	Nil	1	½
6. Making ridges 2 feet apart with a ridging plough.	2	Nil	1	½
7. Spreading 30 cart loads farm yard manure.	Nil	3	Nil	1
8. Transplanting	Nil	10	Nil	1
9. Top dressing with Ammonium Sulphate, Sodium Nitrate or cake.	Nil	2	Nil	1
10. Earthing by hand	6	Nil	Nil	1
11. Plucking fruits.	Nil	12 to 15	Nil	One famale cooly can pluck 400 lbs a day.

ESSENTIALS FOR CLEAN MILK PRODUCTION

S. K. MISHRA, L. AG.

Milk is a perfect food; it contains in the correct proportions all the nutritive elements necessary for the healthy growth and development of the human body. It is however an equally perfect food for those organisms which transmit disease. That is why utmost care must be taken to prevent such organisms from getting into it.

Milk in the udder of a perfectly healthy animal is free from impurities. But at every stage from the time it is being drawn from the cow until it is consumed, it must be guarded from infection. The only way to do this is to keep every thing as clean as possible—the shed, the animals, the milkers, the utensils, the dairy, and the general surroundings.

It is the most easily contaminated of all foods, and it is produced in surroundings which make for contamination, unless very special precautions are adopted.

Dirty milk may be a medium for conveying diseases such as :—

(1) Tuberculosis, (2) Diphtheria, (3) Typhoid fever, (4) Scarlet fever, (5). Malta fever, (6) Sore-throats, (7) Gastro-enteritis out breaks, (8) Dysentry, (9) Cholera.

The essentials for the production of clean milk are :—

(1) Healthy animals.

(2) Clean cattle sheds with adequate light, good ventilation, pucca floor, and good drainage.

Regular cleaning of the sheds is important.

A separate milking shed is desirable.

(3) Clean animals :—

Clipping the hair of the tail, flanks and udder helps to keep them clean. Daily grooming and washing with clean water prior to milking are essential.

(4) Clean seamless utensils in good condition, protected from dust. These should be thoroughly sterilized or boiled. Always clean water should be used for washing.

(5) Clean healthy milkers with finger-nails cut short, dressed in clean white clothes. Each milker should have a washing bowl and a towel for cleaning.

(6) Clean milking with clean dry hands.

The first stream of milk from each teat should be milked into a separate receptacle. This milk should not be used for human consumption as it may be contaminated with bacteria from the canal of the teat. Hands should be washed with soap and clean water after milking each animal. This also prevents spread of udder troubles.

(7) After drawing, the milk should be protected from flies and dust, weighed, recorded, and strained through clean sterilized strainers.

(8) Milk should be kept covered on way to the dairy.

(9) The dairy building should be high lying, pucca, well lighted, well ventilated, cool and fly-proof.

(10) Milk should be bottled or canned in clean bottles or canes which should be sealed and then delivered.

(11) Milk should be pasteurized and cooled for transport to long distances before bottling or canning.

Extracts

REPORT ON THE WORKING OF THE DEPARTMENT OF AGRICULTURE, CENTRAL PROVINCES,

For The Year Ending 31st March 1936.

Expenditure.—The net expenditure on all branches of the department's activities this year amounted to Rs. 8,12,176. Out of this, Rs. 54,545 were contributed by the Imperial Council of Agricultural Research, and Rs. 80,128 by the Indian Central Cotton Committee for research schemes in progress. The net cost to the Province was, therefore, Rs. 6,77,503.

RESEARCH AND EXPERIMENTAL WORK

Cotton.—Outstanding feature of the past season has been the success achieved by the strain. V-434, which was grown extensively. It is now certain that the older strains of V-262 will be replaced ultimately by V-434, the rate of substitution being governed solely by the quantity of seed of the latter available for distribution. Late Verum, a very excellent cotton from the spinner's point of view, has been selected specially for areas in which the monsoon is normally expected to continue late in the season. Unfortunately the character of the past season put late-maturing cotton at a grave disadvantage, for the reason that the monsoon disappeared abruptly in general in the middle of September. Late Verum is therefore likely to fall into some degree of disfavour in the coming season, but it is hoped that cultivators will not lay undue stress on the results of one season, only. On the Nagpur Farm, where a stray thunder-shower fell in the middle of October, late Verum gave a record yield on 914 lbs. per acre. This, in itself, indicates the unwisdom of a too hasty discarding of late Verum in areas where rain normally falls in October. The selection V-438 is reported to have done well in several areas on the lighter description of soil. Two new Verum strains, AK-766 and AK-773, have given very good results both in the field and in spinning tests. The latter has been reported to be suitable for spinning 52's, highest standard warp counts. Selection work is continuing in the direction of securing still higher yield and higher ginning percentage.

Among cottons other than Verum, six new types of Bani 306 and E. B. 31 have been isolated which appear to be highly promising Hirsutum cotton (Buri AK Special and No. 107) have again done well and are becoming popular in Nimar and parts of Berar. Buri AK-Special has given the highest yield on the Akola farm for the second year in succession.

Groundnut.—AK-10 and AK-12-24 have now become fairly well established. The new strain AK-8-11 has given good results on Akola farm. It is very similar to AK-10 in habit of growth, size of pod and oil content, but gives higher out-turn per acre. It lifts more easily and yields 4 to 6 per cent more seed on shelling.

Juar.—Improved Ramkel continues to be very popular.

Rice research scheme.—Results of chemical analysis have shown that a high percentage of total phosphoric acid P_2O_5 in the soil does not

necessarily lead to a high yield of rice, and that there appears to be an inverse relationship between the lime content of the soils of a particular tract and the yields of paddy obtained.

Determinations of soil acidity have shown that in the case of most of the soils examined, the acidity decreases with depth and, as reported in the past, high yields of fine varieties of paddy can be obtained only from neutral or slightly acidic soils.

Most of the soils examined showed a lack of humus even in spite of moderate applications of organic manure, and that the percentage of humus is highest within the top 6 inches. No particular relationship appears to exist between the humus content and the carbon-nitrogen ratios of the soils. The carbon-nitrogen ratio varies very widely in different soil groups and is generally lower at a depth of 6 to 12 inches than in the top 6 inches of the soil.

Hydridization work is being carried out with the double object of scuring heavy-yielding types, and types which can be easily distinguished from wild rice (karga). The hybrid strains evolved so far possess dark-puple auricles or a blackish-purple leaf sheath which introduce a measure of distinction. The most successful crosses evolved so far are Bhondu-into-Parewa. All three are high yielders and are distinguishable from *karga*, and can be definitely recommended for growing in fields infested with wild rice. Efforts are being made to evolve strains which are still more distinct by using *Nagkesar*, a variety in which the vegetative parts are entirely purple, as one of the parents.

Wheat.—The improvements aimed at, in this crop are to produce (*a*) high-yielding, rust-resistant types suitable for the main wheat area in the North of the province, and (*b*) early maturing, hard awned types for the plains of the South. Three of the strains from hybirds obtained by crossing A115 into foreign wheats are again reported to have shown a higher degree of resistance to rust than A115 on Government farms in the Northern Circle. Seed of these is now available for extending the trials to cultivators' fields. Work has continued on another set of hybrids of the early-maturing, awned types suitable for the plateau districts and three strains of those appear to be hopeful. Selection work on Hawra with the object of evolving an early, awned, hard wheat suitable for the Southern Circle again indicates that of the three most promising strains, No. 116 is the best.

Research work in connection with rust-resistance is made all the more complex in that there are several physiological forms of rust and that, although a particular wheat may possess resistance to a particular set of forms, it may be susceptible to other forms. Hybridization with a view to securing resistance to more than one form is in progress.

Linseed.—The object of research on this crop is the production of high yielding types which combine early maturity with resistance to rust. Two strains evolved from crosses between E. B. 3 and a Punjab linseed are reported to have yielded about 40 per cent more than the local small-seeded variety on the Raipur farm. It is hoped that these strains will meet a long-standing need in Chhattisgarh.

Til.—Eight early-maturing selections were grown in randomized blocks on the College Farm, and it is satisfactory that high yield and good oil percentange appear to be combined in Nos. 80, 87, and 92.

Gram.—Of the selected strains under yield trials, No. 352 did not suffer from wilt at all and gave the highest outturn, and No. 62 was again prominent.

Tur.—Seed of wilt-resistant No 38 was distributed in those parts of Berar where wilt causes severe damage. Selection No.3, which is the best all-round strain at present, was grown on all the farms.

Soya beans.—The four selections referred to in the previous report grown on a field scale on the College Farm and gave an average yield of 780 lbs per acre.

Entomological Section.—"Apterite" has been found very effective in destroying the cockchafer grub in gardens and a new proprietory fumigant "Chlorasol" has given good results in protecting stored grain against insect damage.

Mycological Section.—For the control of juar smut, seeds dusted with Agrosan G gave the highest yield of grain. Applications at the rate of one ounce of the fungicide per 10, 20 and 30 lbs. of seed gave practically the same outturn, namely, about 2,000 lbs. per acre. In the control plot sown with smut-coated seed, the yield was 1000 lbs. while smut-coated seed dusted with copper carbonate and sulphur yielded 1,500 lbs.

Tikka disease on groundnut was not serious. Control consists in timely spraying with Bordeaux mixture to which linseed oil or Agral I is

added. Two sprayings one in the beginning of August and the other a month later, are generally enough. A third may be necessary if September is very wet.

Animal Husbandry Section.—The Telankheri farm carries a stock of 39 pure Sahiwal cows and 27 buffaloes. The average production of milk per cow was 3,573 lbs and per buffalo 3,325 lbs. The best performance was by a cow which gave 8,673 lbs, or an average of 24 lbs per day throughout the year.

The stock at Garhi farm consists of 110 cows of the Gaolao breed, which is the only breed indigenous to the provinces that has any claim to distinctiveness of type.

The herd at Ellichpur consists of 34 pure-bred Hissar cows of medium size.

At Pakaria farm in Bilaspur district the stock has been graded up by the use of pure-bred Malvi bulls, the object being to evolve a type suitable to the conditions in the tract.

Economics and Marketing.—An intensive survey is being made of the existing methods by which the various commodities are marketed, according to a programme laid down by the Government of India. Surveys in respect of wheat, rice, linseed, groundnut, eggs, cattle, milk, hides and skins, tabacco and certain fruits were completed during the year; and a further list of commodities will be investigated next year. These surveys are designed to furnish such information as will permit of an accurate picture being drawn regarding current market practices, trends of production and prices, and ebb and flow of supplies.

The Deputy Director who was on leave for part of the year attached himself for a time to the Markets division of the British Ministry of Agriculture and attended the Ministry's demonstrations at the Imperial Fruit and Dairy Shows. He also made enquiries in London, Paris and Marseilles concerning the possibilities of opening up a foreign market for Nagpur oranges.

Marketing of verum cotton.—The number of bales sold through the pool was 6,788.

The rates for ordinary cottons were satisfactory when the pool opened in November, Broach standing at Rs. 226 and Oomras at Rs. 208.

Prices remained around that level until the beginning of the second week in December when Broach dropped to Rs. 217. A further sharp fall occurred on the 5th of January with Broach at Rs. 204, and by the beginning of February it had sagged to Rs. 194, and still further to Rs. 187 before the end of February. Thereafter a slight improvement was in evidence. The factors which brought about the fall were the silver crisis, the decision of the American Supreme Court that their processing tax was illegal, by the progressive release of the five million bales held by the American Government and, finally, political trouble in Japan.

The downward trend of the market had its inevitable effect on the Verum pool. In the early stages very satisfactory prices were obtained, in consequence of which many of the pooling committees formed an exaggerated idea of the value of their cotton and refused to sell even at the comparatively high prices ruling before the serious drop in the market occurred on the 5th of January. Had the pooling committees agreed to part with their stocks as they arrived, instead of hanging on in the hope of a rising market, the average price would have been much higher.

The Marketing Officer rightly points out that a rigid insistence on quality on the part of those responsible for accepting cotton into the pool is more important than the number of bales pooled.

Statistics collected by the districts staff show that inclusive of pool stocks, Verum cotton equivalent to 18,075 bales was marketed up to the end of April.

DEMONSTRATION AND PROPAGANDA

Northern Circle.—The most important work was extension of area under, and the pooling and marketing of Verum.

A notable feature is the growing demand for wire fencing, rahat water-lifts and fruit trees, which indicate an increasing tendency to adopt intensive methods of cultivation.

There has been a general collapse of the Barhi seed unions in Jubbulpore, Saugor and Mandla districts. Successive failure of crops have made it improbable that they will fulfil the purpose for which they were organized and steps are being taken to wind them up.

Southern Circle.—Verum 434, a new strain introduced into the circle for the first time, gave encouraging results. Verum pooling centres were established in seven places. 728 bales were sold and fetched a premium varying from Rs. 8 to Rs. 22 per khandy of kapas over C. P. No. 1 Oomras.

The demand for artificial manures, particularly for cane cultivation, is increasing rapidly. Distribution amounted to 5,438 manuds, mostly sulphate of ammonia.

Special efforts were made to increase the number of private demonstration plots which now number 31. These plots are worked by the owner under the advice of the department. All except four showed a profit. This system of demonstration is very efficient provided the real interest and co-operation of the owner is secured.

The Nagpur Orange Growers' Association was registered in the middle of February and has made a small beginning marketing operations. Share capital to the extent of Rs. 2,900 has been raised. With the very substantial help provided by Government in the shape of taccavi loans to members, advances towards the initial marketing expenses and expert assistance, it is hoped that the association will make substantial progress in coming season.

Eastern Circle.—A striking example of what can be done by co-operative effort is provided in the development of Baghmara village in Balod tahsil. The Union not only meets the seed requirements of the village in full but has also sufficient surplus where-with to run a co-operative farm to demonstrate sugarcane, groundnut and intensive paddy cultivation. This year's profits from the farm have been invested in the purchase of seven acres of land for establishing an orchard. Following the example of the co-operative farm, individual members have grown 83 acres of groundnut this year and planted 50 acres of sugarcane. The introduction of new crops is estimated to have increased the income of the village by at least Rs. 3,000, and the area under sugarcane alone will provide additional work for 100 men for five months and keep them employed in a season in which formerly there was little or nothing for them to do.

Rapid progress is being made in the extension of the area under orchard and garden crops.

In heavy soils under the Maniari tank irrigation gave an increase of 474 lbs. of paddy per acre, while in the lighter soils commanded by the Kharung it was 304 lbs. The more marked effect of irrigation, as compared with the previous year, was due to the early finish of the monsoon.

Of the 5 Government demonstration plots, the most successful is the one at Lormi, under the Maniari tank, which has been instrumental in raising the area under cane from 2 to 256 acres within four years. Given the necessary irrigation facilities in that tract it would not be difficult to develop enough cane area to supply a sugar factory.

Western Circle.—The chief activity in this circle is concerned with cotton and it is satisfactory to note that the new strain V-434 has stood up very well to adverse conditions. It was largely grown on Government farms and seed sufficient to sow 4,000 acres was distributed. All first class seed from that area will be carefully preserved for issue in the coming season. Verum pooling operations were conducted at 26 centres. The total number of bales handled by the marketing organizations was 3,233. The premium obtained for verum kapas over local jari worked out, on an average, to Rs. 7/14/7 per khandi, which was much less than the premium obtained in the previous year. The drop in the price of staple cotton accounted partly for this, but much of the responsibility for lower prices rests with those pooling committees which persisted in refusing reasonable offers in expectation of better ones, and lost heavily in the end by doing so.

The area under groundnut has fallen away from the maximum area of 136,341 acres recorded two years ago to 83,613 acres. It is a comparatively expensive crop to grow. Lifting charges are high and seed costs about Rs. 6 per acre, and the low prices current in the past two years have apparently made cultivators shy of incurring that expenditure. The new strains AK-10 and AK-12-24 continue to give much better outturns than the varieties commonly grown and will help in restoring confidence when conditions improve.

Among the juar varieties introduced by the department, the two that stand out prominently are Saoner and Ramkel. The treatment of seed for the prevention of smut is now widely practised and is likely to become general within the next few years. Nearly a ton of chemicals for this purpose was issued, sufficient to treat seed for almost two lakhs of acres.—*Abstract (Report on the working of the Department of Agri, Central Provinces for the year ending 31st March 1936.*

PROBLEMS OF CONTROLLING PEST MOSQUITOES

General.—In general, problems of controlling mosquitoes involve the selection of the vulnerable stage or stages and the use of physical and biological methods.

It seems reasonable that historically the first attack upon the pest mosquito consisted of squashing the biting female and repelling them with smokes and vapours. The modern counterpart of this attack up the adult appears in the utilization of the New Jersey larvicide for protecting small or large aggregations of people who, for one reason or another, wish to hold outdoor meetings in mosquito-infested territories. This method has been developed to an extent where we are now able to say that it is practical and useful. Audiences consisting of, as many as 20,000 people have been fully protected by proper use of this larvicide prior to the opening of the meeting and at certain times during the meeting.

Because mankind did not readily connect either the egg or wriggler with the buzzing, biting mosquito, it was not until recent times that any effort was made to attack the mosquito through destroying these immature stages.

Attack upon the eggs, particularly of those species that lay their eggs in the soil, has begun as a subsidiary mosquito control process and it has become the practice, using waste lubricating oils to treat the sloping borders of pools and the empty temporary water-holding depressions during the non-breeding season with oils of this character. A great disadvantage in the process lies in the destructive effects of this treatment upon the vegetation and consequently upon the appearance of treated places. This disadvantage is a very serious one in highly populated districts and is certain to continue to form a limiting factor in the application of this method.

With the discovery that mosquito larvae and pupae could readily be killed by placing kerosene on the surface of the water in which the wrigglers were living and growing, and the realization by advanced thinkers among the public that if all mosquito-breeding waters were thus treated the mosquito pest would disappear, mosquito control activities were shifted to this field of endeavour and for a period of 35 years or so have been centered upon this line of attack. The strategy in mosquito warfare has long been based on the principle that in as much as all mosquitoes pass an essential stage (the wriggler) in water the elimination of all such mosquito-breeding waters by removal or by treating in such a

fashion as to render them unsuitable for mosquito brood development is followed in due course by elimination of the mosquito pest. This principle is still basic for the great bulk of the mosquito control work in this country today.

Physical methods against mosquitoes are as old as the human race and in many instance are the only methods still practiced. The early physical methods included squashing of the biting females. Today, accepted physical methods consist principally of removal of mosquito breeding waters by drainage or filling and the building of dikes, dams and gates for the impounding and manipulation of water. The use of mosquito extermination traps, as has been practiced in some parts of France, must also be classed under this head.

Chemical methods include the use of larvicides of various forms and repellents of various kinds. The commonest larvicide is, of course, fuel oil but fuel oil has the disadvantage of being injurious to fish, waterfowl and aquatic plants. Ginsburg (1935) by reducing the amount of oil to not more than 3 gallons an acre and impregnating it with pyrethrin has been able to form an efficient larvicide at about half the price of fuel oil and which is not injurious to fish, waterfowl, and aquatic plants. It has been shown that the distribution of Paris green as a dust is ineffective in dealing with the surface feeders. Furthermore, the use if arsenicals of any kind on potable waters, while these waters are being used for human consumption, is very largely out of the question. Many other chemicals have been used and have been shown to kill mosquito larvae but either their toxicity to man and animals or their cost has rendered their employment inpracticable, There is, of course, the undeveloped possibility of treating pools and pool bottoms with chemicals to prevent the development of mosquito larval food.

The only natural enemy of really great importance in mosquito control is the wriggler-eating fish. Where an abundant supply of these fish is available and can reach all parts of mosquito-breeding waters practically no mosquitoes reach maturity. Many other natural enemies have been cited, including bats, insectivorous birds, mites, round worms and certain protozoa. None of these, however, has ever been successfully used for mosquito control. For a time the use of bats was widely advocated but from all reports which the writer has examined their utilization appears to be more or less of an idle dream. Nevertheless, it

is possible that we would have far more of pest mosquitoes in this country if it were not for the work of these obscure natural enemies.

Specific.—In dealing with mosquito control specifically the first problem is to obtain an accurate knowledge of the mosquito fauna of the district to be protected. This is best obtained through the agency of a mosquito trap survey. Traps are set near or among shrubery in the backyards of towns and cities of the area. The number of traps utilized is variable, depending upon the nature of the terrain. More traps will be necessary in a town or city located among the hills than in town or city located on a flat plain because the hills interfere with the normal distribution of the insects on the wing. It is usually sufficient to trap for one full mosquito season because it is rare that the species composing the fauna do not at some time in a season make their appearances. For the sake of understanding the time of appearance of the different components of the fauna it is advisable to keep each night's collection separate from the others. A record of species and numbers representing them should be carefully made. With these data in hand the entomologist should be able to form an excellent and reasonably accurate picture of the mosquito fauna of the district. Should these trap records show the presence of species of breeds of which experience indicates does not occur in any of the breeding places within the protected area, a case of migration has appeared and it becomes necessary to trace the source of this migration immediately in order that the factor of migration into the protected area from the outside may be evaluated and taken into consideration when the plans for practical work are being formulated.

The second problem in mosquito control is the formation of an organization for carrying out the practical work. In this problem there are several important factors. First and foremost a mosquito man, that is a man who understands the habits and activities of mosquitoes, must be secured to head the work. The problem of mosquito control is a biological problem and only to a very limited extent engineering in nature. The engineering involved is ordinarily very simple while the biological phases of the problem are sometimes very complex. Naturally the mosquito executive must have the ability to pick satisfactory help, must be able to maintain a proper contract with the people being served and must be free from so called political interference. Without doubt moneys used for mosquito control are participated in by all persons living in the protected districts. An unpaid body, representing the people of

the protected district to whom the mosquito executive is responsible, is the writer believes, a necessary provision. When the protected district is menaced by migrations from outside it's boundaries it becomes necessary either to increase the size of the area to be protected to include these sources or to have work undertaken outside the area for the purpose of controlling such broods.

It is a matter of extreme importance to be able to measure with reasonable accuracy the results of practical anti-mosquito work and it is thought that the most satisfactory measure of this sort can be found in the determination of the composition and density of the mosquito fauna in the protected district. This determination should begin with appearance of mosquito and should not close until the weather grows too cool for mosquito activity. Here again the mosquito trap is an invaluable instrument and costs for its establishment and operation only a small percentage of the total moneys involved in carrying on the practical work.

A review of certain correlations between the number of female mosquitoes taken in traps and human discomfort should be interesting and worth while. At the outset of most mosquito projects the first criterion of results is the presence or absence of complaints by citizens. Experience over many years of practical mosquito work indicate that such complaints come usually when mosquitoes are sufficiently abundant to penetrate the houses and give trouble to the occupants at night. A protected community can have a high population of mosquitoes and yet be practically free of such complaints. Then comes the stage at which the protected population demands freedom from mosquito biting on its unscreened porches during warm evenings. It has been found that a mosquito trap properly placed can catch as many as 24 female mosquitoes and the desired porch freedom be secured. This is about the point where most mosquito control work is at the present time. In the future, however, the demand of the householder that he be able to work his garden in the dusk of warm evenings without being bitten by mosquitoes is at hand. Experience with the traps indicates that not more than five female mosquitoes can be caught per trap per night and give this degree of mosquito freedom. Most of us are still far short of bringing mosquito control work to the level of this criterion.

Rainfall has much to do with the mosquito control problem. It is not alone the water which falls at any one time that creates pools from

which a great brood of mosquitoes escape but the distribution of rainfall in relation to the question of maintaining pools established long enough for a mosquito brood to develop. Rainfall which creates hundreds of, thousands of temporary pools and which comes frequently enough to maintain them over a sufficient period of time is the condition which constitutes the maximum load of mosquito breeding and it is rarely indeed that any mosquito fighting organization finds itseif competent to handle the mosquito problem fully under this sort of conditions.

ONE HUNDRED YEARS AGO JOHN DEERE GAVE TO THE WORLD THE STEEL PLOW

John Deere, the village blacksmith of Grand Detour, Illinois, rolled up his sleeves and went to work—a determined young giant, intent on working out an idea that obsessed him. The hammer's blows rang louder on the anvil; in the fire of his forge, he saw a glowing vision—the vision of a self-polishing plow that would shed the black, sticky soil of the vast Prairie Empire, and insure the permanency of agriculture in the New West.

Farmer Lewis Crandall, from across the river, had furnished the incentive. "John" he said, "if you can't make a plow that will scour in this sticky land of mine, I;m going back East."

And Deere had said; "Lew, if I can't build the plow you need, I'll likely be going back East with you."

Crandall's problem was the problem of all the settlers.

* * * *

Unyielding as Vermont's granite hills that had sheltered him in his youth, John Deere carried on, beset by hardships, besieged by hapless neighbours, the young blacksmith held steadfastly to his purpose. He would build a plow that would conquer the stubborn prairie land. That was his answer to a challenge. He had pride as a craftsman and the courage to commit himself to a task that everyone said couldn't be done.

A broken mill-saw blade of shining steel for the mouldboard and share, landside, and standard of wrought iron, beam and handles of white oak—that was John Deere's first plow.

Many weary hours were spent in field tests. Back and forth went John Deere, from shop to field, from field to shop, toting the test plow on his shoulder, cutting furrows, making adjustments, pounding out imperfections—and finally-success; his self-polisher has scoured and turned clean furrows in Crandall's land where everyone said no plow would work. The stubborn soil had yielded—the conquest of the new Canaan was on.

* * * *

It was not written that a man of John Deere's many accomplishments should go through life as a village blacksmith, more than a manufacturer—he proved later, in building up his business, that he was endowed with a high quality of leadership; men were attracted to him, respected him, remained loyal under him.

With amazing perception and an indomitable spirit, this rugged craftsman, while untrained in business practice, quickly analyzed and mastered the problems that confronted him—problems of procuring materials, problems of finance, of manufacture, of transportation, of marketing. Formidable barriers they were, back in the days when "Wilderness was King"; when Chief Blackhawk and his warriors roamed the hills.

* * * *

Farther and farther into the hinterland the John Deere self-polishers were peddled. Ox-Cart, River-Packet, Stage-Coach horse and Wagon—all had a part in the marketing of these first plows.

As the railroads projected their steel spurs farther westward, and the outposts of commerce were extended, John Deere gradually built up his dealer organizations. His constant aim was to have his products marketed through the most substantial agent in a town. In this effort he was highly successful.

Today, there are thousands of John Deere dealers, serving every farming community, keeping faith with the century—old business principles handed down by John Deere. A large majority of these dealers have been indentified with the House of Deere for many years; in not a few cases their businesses have been passed on as an heritage from generation to generation.

Today, there are eleven John Deere factories, which have grown from John Deere's one-anvil shop. Each factory specializes in the manufacture of particular implements, and the products of all are distributed through fifty-five branch houses and sub-branches.

* * * *

John Deere has gone, but his name is written indelibly in the history of agricultural progress. His good works live after him, standing as an enduring monument to rugged honesty and sound business principles.

A review of his life work reveals that he had done much of which he might well have been proud.

His plows had been used to conquer untamed wilds in many lands. Civilization had advanced behind his plows. The world was more prosperous and happier becuase of his plows.

But John Deere's ruling pride was not so much in the great end attained as in the way, the end had been reached. He felt most pride in the consciousness that he had never produced a plow of poor quality. Early in his career, he had said; "I will never put my name on an implement that hasn't in it the best that is in me." His was the pride of the master craftsman.

The pride that John Deere felt is the pride of the makers of John Deere farm equipment, today, as they observe the centennial which marks the 100th anniversary of the birth of John Deere's steel plow. It is a powerful incentive to the maintenance of the high standard to which John Deere implements have been kept up through the years.—*(The Furrow Jan. Feb. 1937.)*

COLD STORAGE EXPERIMENTS WITH NAGPUR ORANGES

Experiments were conducted at Poona under the patronage of the Imperial Council of Agricultural Research, India, in connection with Cold Storage requirements of important Indian fruits and vegetables. A Cold Storage plant was installed in 1934.

The oranges used in these experiments were obtained directly from Nagpur. On arrival at Poona by train those that showed any blemish or puncture were rejected. The selected oranges were graded according to stage of maturity as (a) green (b) turning and (c) yellow or fully ripe.

The fruits of the three grades were stored at the four temperatures, 35°F, 40°F, 45°F, and 52°F and also at room temperature which ranged from 77°F to 90°F between 27th March to 30th April 1935.

Experiments were also carried out to investigate the effect of different pre-storage treatments on Nagpur Oranges. The fruits were given the following treatments.

1. Washing with
   (a) Water,
   (b) Copper Sulphate solution.
   (c) Potassium Permangnate solution.
   (d) Borax solution (washed before despatch from Nagpur)
2. Besmearing with
   (a) Zinc Oxide powder,
   (b) Magneseium oxide powder.
3. Coating with a thin film of Paraffin wax.
4. Wilting at room temparature.

The results of the above experiments show that :—

1. Fully ripe yellow oranges could be kept in a good condition for three months at 40°F. without any appreciable wastage.

2. Green and turning fruits, although they changed to a good yellow colour at 45°F. and 52°F., lost their juice during storage.

3. Discoloration of stem-end due to the development of Dark-button was specially marked in green and turning fruits in the beginning of the storage life.

4. At 35°F and 40°F., fruits of the three stages of maturity developed 'internal breakdown' after varying periods of storage.

5. At 45°F. and 52°F., there was appreciable wastage due to Alternaria disease.

6. Pre-storage treatments such as washing with antiseptic solutions, etc., were of no particular value in lengthening the storage life of the fruits.—(*Extract from The Indian Jour. of Agri. Science.* Vol. VII, Part I, *February 1937*).

BENGAL'S "VILLAGE OF THE DAWN".

Rural uplift.—A description of the social activities in the way of rural reconstruction being carried on at Ushagram (Village of the Dawn), a model village two miles from Asansol, was given by Dr. F. G. Williams, Director of Ushagram, at the weekly luncheon of the Rotary Club of Calcutta at the Great Eastern Hostel.

Dr. Williams said that Ushagram is a village built with materials from Bengal and where all lived in mud cottages. There are gardens, roads, playgrounds, shops, a co-operative store, a maternity centre, a church, a creche, farm and a high school. Each day 200 girls and 500 boys fill the village to study in school, work in shop and on the farm.

Of these about 120 are resident in the cottages. There are 35 Indian teachers of whom more than half are resident. And so the school has become a village—a laboratory of rural living where the problems of the village might be solved and demonstrated.

The motto of Ushagram, Dr. Williams added, is "Better citizens in better homes in better villages." That should be the ideal of every rural school. Education should teach the rural child to do better those things which he would do any way. Any school to make such a contribution to rural living must be organized in line with the cultural forces in which it found itself. For the Matriculation examination two girls and 34 boys were sent up. Both girls passed and 28 boys.

Other group activities carried on by the students and teachers in Ushagram included a co-operative water works system, an annual three-day agricultural fair or mela, evening adult school, vacation literary schools, extension of library service, play day programmes of Scouts, folk dancing by Bratacharis, drama and music by literary clubs.

In conclusion Dr. Williams said that he liked to think of Ushagram as a laboratory of rural living where experiments could and were being carried out in line with the economic possibilities and cultural genius of the people within its sphere of influence. It was a laboratory not in the pure scientific sense but rather more in the sense of a demonstration and proving ground where people could see how it worked. Perhaps the best thing about it was that it was being done by a group of very ordinary people with very ordinary materials, both human and physical, taken from the local environment.

HOW IS YOUR ACCOUNT?

A farm may be readily compared to a bank account. The bank depositor who continues to draw out money without making any deposits, soon has no account. And, the farmer who continues, year after year, to draw the fertility out of this soil, will in time find himslef with no farm.

Thousands of farms in America today lie unused, deserted, with crumbling buildings and falling fences; underbrush encroaching from every side, the barren fields rutted by erosion. They are closed accounts.

With proper methods of soil building and conservation, a farm need never wear out, but may continue, year after year, to increase in fertility and value. It is but the simple matter of replacing the plant food taken away with each crop. That is, keeping the deposits up with the withdrawals.

The live-stock farmer has a great advantage over the one-crop farmer, as he can, by carefully saving all manure, and rotating his crops, constantly balance his plant food withdrawals and build up his soil year after year. An Alabama cotton farmer reports that his farm, when he first brought it, would produce but one bale of cotton to each three acres. After ten years of proper management, in which he used legumes and live-stock to help rebuild the soil, he was able to produce a bale to the acre. It is not unusual for Corn Belt farmers to build up their farms from a 40 bushel per acre average to an 80 bushel average.

Methods for soil building are individual problems. The wise farmer carefully analyzes his lay out, considering cropping plans and markets. His fields are platted, and long time rotation plan established, with a maximum of legumes. All manure is saved carefully and returned to the soil. He purchases lime and commercial fertilizers if there is a shortage in his soil that cannot be replaced by other methods. He constantly guards against that farm bank-robber-land erosion.

Such a farmer is making deposits to equal his withdrawals. He is on the road to lasting prosperity.—(*The Furrow Jan. Feb. 1937.*)

DIET DEFICIENCY IN SOUTH INDIA

Dangers of using Milled Rice.—The report of the Scientific Advisory Board for the year 1936 is of special interest to South India, especially

those sections which deal with nutrition research and the investigation of the etiology and pathology of peptic ulcer. It is of interest to note that stomatitis is a common food deficiency disease in South India caused by lack of one or more of the factors present in the vitamin B2 complex.

There has already been a considerable amount of investigation and planning of diets. The effect of the nutrition value of Indian cooking methods is, it seems, being studied, and reference was recently made to value of Red Palm Oil as source of vitamin A activity.

The Supplementary value of skim milk has been fully confirmed by controlled experiments of school children, and a similar trial of effect of the Soya bean is reported to be in progress. The condition of the skin known as "Thrynoderma" has been reported in India, it is said for the first time.

"Thrynoderma", and "Stomatitis" are common in South India children mainly due to faulty diet. It is a curious fact that former disease, common in many parts of the Madras Presidency, is very rare on the west coast. Another point of importance is that children in the rural areas show these symptoms less commonly than children in the urban areas. Where millet is commonly consumed (as in the villages) the state of nutrition in general is better than in the urban areas where the only cereal is milled rice. Village populations have further advantage of consuming home-pounded rice. South India would do well to note the following observation in the Report: "While living standards in India remain at their present level, the extension of mechanical rice-milling in rural areas must be viewed with alarm".

Further, it was noted that stomatities regularly occurs when the diet is largely composed of milled rice and contains very little of milk and a minimum of pulses, vegetables and meat; and that the inclusion of a fair quantity of millet, *e. g.* ragi, in the diet prevents its occurrence. Curative experiments have been carried out, revealing that this form of stomatitis is rapidly cured by unheated yeast and skimmed milk.

Skim milk.—Another matter which received detailed consideration was the high incidence of peptic ulcer in South India and its comparative rarity in Northern India. As a result of enquiries, it was found that peptic ulcer is found in the Southern Maharatta Country, and Southern Hyderabad, is fairly common all through the Madras Presidency and very

common in Travancore, Cochin and Malabar. It would appear that in the areas where ulcer is common, there was an excess of carbohydrate in the diet, a deficiency of protein and fat, and a general vitamin deficiency in which Vitamin A appears to be the most poorly represented. According to Sir Robert McCarrison, duodenal ulcer was 60 times more common is South India than in Northern India and even more so in Travancore, Cochin and Malabar. It is a curious fact that the vast majority of cases are among males. It is also noted that while the disease was found in all classes of the population, by far the largest number of cases were drawn from the poor middle classes. Another point worthy of note was that fisher-folk, living as they do on a dietary in which there is always a large quantity of fresh fish, were singularly exempt from Peptic ulcer.—(*Extract from the Hindu*)

INDIAN TEA STATISTICS

Decline in production and Export.—A large decline in production and export of Indian tea and a corresponding increase in the import of foreign tea into India has been recorded in the Indian Tea Statistics for 1935, just published.

The total production of both black and green tea in 1935 is reported to have been 391,429,000 lbs. (of which black tea represents 390,230,000 lbs.) The net decrease, as compared with the preceding year, amounts to 4,822,000 lbs. which is mainly shared by Assam and Bengal. The total quantity of green tea reported to have been manufactured in the year under review was 4,199,200 lbs. as compared with 4,519,500 lbs. in 1934.

The highest production in the year was in Lakhimpur (Assam), namely, 657 lbs. per acre, and the lowest in Garhway (U. P.) namely 25 lbs. The average production in the whole of India was 513 lbs. per acre plucked, as against 522 lbs. in the previous year.

The total area under tea in 1935 was 826,800 acres, a net increase of 500 acres.

Total exports abroad in 1935-36 by sea and land was 313,262,000 and 15,838,000 lbs. respectively as compared with 325,070,000 lbs. and 22,117,000 lbs. in the previous year. The total exports by sea decreased by 12 million lbs. or 4 per cent as compared with 1934-35. Decreases were noticeable in the exports to the United Kingdom, the Netherlands, European Turkey, Egypt, Anglo-Egyptian Sudan, Canada, the U. S. A.,

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Chile, West Indies, Arabia, and Australia. Shipments to the United Kingdom, the largest outlet for Indian tea, decreased by 13 million lbs. As regards the other European countries, exports to the Irish Free State the U. S. S. R., and Asiatic Turkey increased heavily from 1,807,000 lbs., 40,000 lbs. and 178,000 lbs. to 3,026,000 lbs., 976,000 lbs. and 313,000 lbs. respectively. Despatches to the African countries declined by 7 per cent. Shipments to America declined by 12 per cent.

Compared with 1934-35 the exports of tea from the important ports in India during 1935-36 recorded decreases. The shipments from Calcutta, Chittagong and Bombay and Karachi ports decreased by 12,532,000 lbs. 1,681,000 lbs. and 161,000 lbs. respectively, while those from the South Indian and Burma ports rose by 2,551,000 lbs. and 15,000 lbs. respectively.

Imports of Foreign Tea.—The total imports into India of foreign tea in 1935-36 were 5,126,000 lbs. or 2,051,000 lbs. more than those in 1934-35. the quantity re-exported as foreign tea was 6,100 lbs.

Imported from	1934-35.	1935-36.
	lbs.	lbs.
Ceylon	512,000	563,000
China	1,440,000	3,250,000
Other Countries	1,123,000	1,313,000

Deducting net exports in 1935-36 and the stocks left at the end of the year from the production in 1935 plus stocks left at the end of the preceding year, the quantity available for consumption in 1935-36 may be placed at 83 million lbs. as compared with 70 million lbs. in the previous year. Burma in addition to leaf tea, consumes a considerable quantity of pickled tea (letpet), mostly imported from the North Shan States.

The total number of persons employed in the industry in 1935 was returned at 899,039 of which 845,028 was permanent and 54,011 temporary. This is a decrease of 2,064 permanent and 3,231 temporary than in 1933-34.

The total amount of tea cess collected in 1935-36 was Rs 23,29,000 as against Rs. 16,10,000 in 1934-35. During the year the cess was increased from 8 to 12 annas.—(*Extract from the Hindu.*)

AGRICULTURAL RESEARCH COUNCIL

The next meeting of the Advisory Board of the Imperial Council of Agricultural Research will be held in Simla from September 13 to 18. The first day will be devoted to open general session, after which the Board will split up into sub-committees, lasting till Thursday September 16.

The most important item of business will be the consideration of Sir John Russell's report, after which the Board will take up examination of progress reports and review the results of working of old schemes and consideration of new ones, the most important being discussion of steps taken to encourage milk supplies in the cities. In this connection the observation of provincial officers about the recommendation of the last meeting in the matter of establishment of milk production areas in and outside cities will be most useful. Further examination will be made of the proposals for salving the best dry cows from cities.

In conjunction with the meeting of the Advisory Board, a conference of the horticultural officers will be held for the purposes of co-ordinating efforts in fruit production in the various provinces.—*(Extract from the Hindu.)*

BANANA AND POTATO

Therapeutic Value.—The banana has a high caloric or fuel value, yielding over 400 calories to the pound. One large banana supplies about 100 calories. It is richer in solids and lower in water content than other fresh fruits. It's high content of easily assimilable sugars makes it a good source of quick energy and provides an excellent means of fatigue recovery.

The following minerals are supplied to the diet by the banana; calcium, magnesium, phosphorus, sulphur, iron, and copper. In its iron content the banana is second only to the strawberry. Leitch states that 'bananas figure outstandingly among such foodstuffs as are certain to introduce iodine into the human system'. Its alkaline ash contributes to the alkalinity of the blood. The protein and fat content of the banana is too small to constitute a perfectly balanced ration. With the addition of milk, which is rich in protein and fat, it provides a ration that supplies all the nutritional needs of the body.

The vitamin content of the banana is high. It has been found to be a good source of vitamins A, B, and C, and it contains also vitamins G and E. Owing to its vitamin C content, the banana ranks second only to the orange as a preventive of scurvy. Experiments made here in India showed that when an animal developed scurvy and was losing weight, the addition of banana pulp to its diet cured and prevented the disease and also enabled the animal to gain in weight steadily.

Similarity.—There is a similarity between the banana and the potato with regard to carbohydrates and the same caloric value, but the banana has the advantge over the potato that it can be eaten raw, thus ensuring the administration of the vitamins which may be destroyed in cooking. It has been found that banana baked in the skin retain their scurvy-preventing properties better than when baked without the skin, probably on account of the protective action of the skin against oxidation.

Several investigators have reported that the banana appears to have the ability to stimulate the growth in the intestine of the aciduric type of bacteria, and to combat the development of the colon forms. In cases reported by Kahn, this effect was produced in infants in from tewenty to thirty-five days. The banana has an antiseptic action on the decomposition products in the intestine. Its value as a regulator of gastro-intestinal function may be due to this fact.

It is only in recent years that the banana has been included in the child's diet list. Owing to studies made during the past few years, the fully ripened banana has taken its place as a most valuable source of carbo-hydrate in the diet of infants and children. The addition of mashed banana to the milk mixtures of artificially-fed babies is now recommended.

The difficulties inherent in the feeding of bananas to bottle-fed infants are removed by the use of banana powder. This is well tolerated by infants, even in the first weeks of life. In infants so fed, Dr. Haas found that there was a marked acceleration of growth during the first six months. The infants were ruddy, firm and contented, and their teeth, which do not erupt earlier than usual, were hard, white, and had good enamel.

Great improvement was noted in school children when each child was given two bananas and two glasses of milk during the school day, in addition to the regular lunch.

Therapeutic Value.—The therapeutic value of the banana is thus summed up by Dr. Von Noorden:' It's readily assimilated sugars along with vitamins and minerals make it of value in infant feeding. Its caloric value added to its vitamin and mineral content, make it of value in the treatment of malnutrition. Its low protein and salt content, along with its high carbo-hydrates make it useful in the diet of patients with disease of the kidneys. Its alkaline residue tends to combat acidosis. Its vitamin content is of value in preventing deficiency diseases. Its soft texture and blandness are of value in the treatment of intestinal disorders, its satiety value in reducing diets in the cure of obesity.'

Of late years, the banana has been used with very good effect in the treatment of intestinal disorders, especially sprue, both tropical and non-tropical. In refering to the dietetic treatment of sprue, Barborba makes mention of the banana cure developed in New Orleans, which consists of the daily diet of from ten to fifteen bananas.

'The only particular difference in the diet of the natives of Jamaica and Barbados was that in Jamaica the peasants had bananas and in Barbados they did not. The dietary difference is of interest in connection with major Ashford's observations on sprue. He noticed that sprue occurred in the cities and towns of Puerto Rico, where the carbo-hydrate element of the diet was made up of bread, and it did not originate in the country districts where the peasants secured his carbohy. drates by eating banana. In Barbados sprue is very common and bread is the staple carbo-hydrate food there. In Jamaica sprue is very rare, and the peasants subsist very largely on banana.—*(Extract from the Oriental Watchman.)*

IRRIGATED AREAS IN INDIA

An idea of the importance of irrigation to India may be had from the latest statistical information available.

The total irrigated area in British India in 1934-35 was 50,534,000 acres as against 50,508,000 acres in the preceding year. Of this area, 22,404,000 acres were irrigated from Government canals, 3,667,000 acres from private canals, 12,527,000 acres from wells, 6,213,000 acres from tanks, and 5,723,000 acres from other sources of irrigation.

Irrigation is ordinarily resorted to on an extensive scale only in tracts where the rainfall is most precarious. In Lower Burma, Assam and Eastern Bengal, and on the Malabar Coast (including the Konkan), where rainfall is ordinarily heavy, the crops hardly need the help of irrigation, unless there is an unusual scarcity of rain. Of the total area irrigated, the Punjab accounted for 29 per cent. the United Provinces 21, Madras 18, Bombay and Bihar and Orissa 10 each, and the other Provinces for the remaining 12 per cent.

Irrigation percentage.—The proportion of irrigated to total area sown in each Province was as follows :—

Punjab 54, North-West Frontier Province 44, Ajmer-Merwara 38, United Provinces 30, Delhi 29, Madras 28, Bihar and Orissa 21, Bombay 16, Assam 11, Burma 8, Bengal 7, Central Provinces and Berar 4, Coorg 3.

If the areas sown more than once are taken as separate areas for each crop, the gross area of irrigated crop comes to 54,193,000 acres. Of this area, 84 per cent. was under food crops. Of food crop area again, 18,398,000 acres were under rice, 11,212,000 under wheat, 2,622,000 under barley, 1,374,000 under jowar, 988,000 under bajra, 1,016,000 under maize, 1,990,000 under sugarcane and the remaining 8,165,000 acres under other food crops. Of the irrigated non-food crop area, 3,381,000 acres were occupied by cotton.—(*Extract from the Times of India.*)

INDIAN COFFEE PROPAGANDA

Work in Britain.

Over 4,000 cups served free.—Over 4,000 cups of Indian coffee were served free at a small stand in the recent British Industries Fair. Besides this form of publicity, the report of the Indian Coffee Market Expansion Board in London for the first quarter of this year gives details of other ways in which contacts are being made with provision merchants' associations throughout the United Kingdom and thousands of show-cards posters and leaflets have been distributed.

The Board, which is a branch of the Indian Coffee Cess Committee established last autumn, has written to various institutions, such as hospitals and schools, pointing out that Indian Coffee is among the finest in the world and can be had at prices competing with those of any other Empire country. Satisfactory replies have been received and good orders

have been placed. Other public bodies, such as shipping and railway companies, are now to be approached.

Meantime, work is going ahead with the collection of statistics of the consumption of coffee in the United Kingdom and the Continent. These, when ready, will, it is hoped, prove valuable in showing where the coffee trade may be expanded.

Valuable work was done by the Coffee Stand at the British Industries Fair. In it, a woman demonstrator showed the simplicity of making good coffee. One thousand two-ounce sample packets were given away and 2,000 sample packets were sold at two pence each. In fact, the demand for samples of coffee exceeded all expectations, and many more could have been sold. Important contacts were made at the exhibition with people in the coffee trade and are now being followed up.

An amusing experience of the organisers of the campaign on behalf of Indian Coffee was the absence of knowledge of the rudiments of Indian geography among retailers. For instance, some of them did not know that Mysore was in any way connected with India, but on the other hand it was found that the coffee traders in London not only knew the names of different coffee districts in India but also how to pronounce them.— (*Extract from the Times of India.*)

MILK SUPPLY IN C. P. & BERAR

Information gathered from four villages in each district of the Central Provinces, reveals that the estimated daily total production of milk is 22,432 maunds, of which 50 per cent, is consumed by the producers. Of the total fluid milk available for sale, 1,923 maunds are sold in villages and mofussil towns, and the rest, 182 maunds, in cities.

The daily consumption of milk per head in certain mofussil towns averages 6 tolas. If only half this quantity is consumed as fluid milk, then the *per capita* consumption is 2 tolas. The daily consumption of fluid milk per head in cities is about 3, tolas. Practically all milk, excepting that supplied by organised dairies, is watered, and the public is apathetic towards any improvement in the quality of the milk.—(*Extract from the Times of India.*)

CONSOLIDATING SMALL HOLDINGS IN THE C. P.

By The Commissioner of Settlements

The evils of fragmentation of holdings have attracted attention in the Central Provinces for some years past but attempts made to deal with the matter on a voluntary basis were not very successful. Owing to local conditions and history the position was particularly acute in Chhattisgarh division which is the principal rice growing country of the province and though prosperous is generally its least developed area. Fragmentation in this part of the province is so extreme that separate embanked rice fields are found as minute as 1/10 or 1/20 of an acre, and parts of a single holding as far as a mile apart.

After consultation with all interests concerned, it was decided that the only way to grapple with the problem was by means of legislation and accordingly the Central Provinces Consolidation of Holdings Act was passed in 1928. Briefly, the method adopted for effecting consolidation in a village in respect of which the requisite application has been filed and admitted is to set up a panchayat or committee of five members of the villagers selected from amongst the landlords and tenants.

This committee in the light of its local knowledge, prepares a valuation of the fields of all holdings in the village and then proceeds with the assistance of the Consolidation Officer and his staff to redistribute the fragments of the holdings so as to make them as compact as possible, the general idea being to reconstitute the new holding as far as possible round the nucleus of some part of the old fragmentary holding. The scheme when ready is confirmed by the district officer and during the last eight complete years during which the Act was in force no fewer than 928 villages with an area of 894,600 acres have been consolidated at a cost of Rs. 2,40,000.

Up to September, 1931, consolidation was done free without recovering the cost of the special staff employed for the purpose but since then, as it has been well-established, Government charges the villagers Annas four per acre and applications are entertained only from the villages which are prepared to meet the cost of the operations. As a result of consolidation, the number of khasra numbers (fields separately recorded in the village papers) has been reduced by no less than 84 per cent. The work is so popular that we find it difficult to meet the demand and we are shortly having a third party posted to Bilaspur district.—(*Extract from the Times of India.*)

ARTIFICIAL RAIN

Experiments in U. S. S. R.—They make rain in Soviet Russia.

A scheme to pour artificial rain on an area of about 4,000,000 million acres of arable land is being arranged by the Academy of Agricultural Science. Experiments with artificial rain on cotton, sugar-beets and cereals in the arid zones in the U. S. S. R. have provided that in this way the harvest of these crops can be increased two to three times. The yield of raw cotton and the percentage of sugar in beetroots, for instance, had been considerably increased by artificial rain.

In the Stalin State farm of the Voronezh region artificial rain has increased the harvest of sugar beets five times as compared with the fields not subjected to artificial rain.—*(Abstract from the Leader)*

Crop Forecast

FOREIGN COUNTRIES

Cotton crop of the United States of America.—According to a cable dated the 8th July 1937 received from the United States Department of Agriculture, Washington, the area under Cotton in the United States of America during the current season is estimated at 34,192,000 acres, as against 30,960,000 acres the corresponding revised area of last year.

Wheat and Linseed crops of the United States of America and Canada.—According to a cable dated the 9th July 1937 received from the United States Department of Agriculture, Washington, the area and yield of the Wheat and Linseed crops of the United States of America for the current season are now estimated at 68,198,000 acre and 882 million bushels (or 23.6 million tons) for Wheat and 1,081,000 acres and 8 millions bushels (or 0.2 million tons) for Linseed. Last years' corresponding estimates were 51,059,000 acres and 638 million bushels (or 17.1 million tons) for Wheat and 1,698,000 acres and 6 millions bushels (or 0.22 million tons) for Linseed.

According to another cable of same date received from the Dominion Bureau of Statistics, Ottawa, the condition of wheat and linseed crops of Canada for the current year is reported to be 52 per cent and 44 per cent of the normal respectively.—*(The Indian Trade Journal July 15 1937.)*

College and Hostel News

After the spell of arid summer, the College opened on the 15th June to face the new session and within twentyfour hours launched on its journey of normal routine work.

As usual the election of office bearers for the various activities took place on the 26th of June and the following were elected. Our hearty congratualations to them.

General Secretary	... Mr. V. D. Deshpande 3rd year.
General Secretary (for sports)	... Mr. T. G. Deshpande ,,
Cricket Captain	... Mr. G. D. Tatwawadi ,,
Football ,,	... Mr. Y. R. Saoji ,,
Hockey ,,	... Mr. S. N. Sakalle 2nd year.
Tennis ,,	... Mr. I. S. Dubey 2nd year.
Indoor Games Secrertary	... Mr. M. D. Patil 3rd year.
Librarian (Hostel Library)	... Mr. Ashgarh Ali Raja ,,

The students displayed great enthusiasm in the election and the unanimous choice in most of them was a clear proof of the popularity enjoyed by those who were elected. Sturdy yeomen one and all refreshed by a well earned rest are full of hope for the future; this is a great promise.

The next election pertained to a more academic sphere of activity, and the following students received unanimous support in their election to the debating society personnel.

Vice President	... Mr. B. P. Upadhyaya 4th year.
Secretary	... Mr. D. C. Jain 3rd year.
Joint Secretary	... Mr. N. B. Gupta ,,
Elected members	... 1. Mr. M. C. Gangrade,,
	2. Mr. K. S. Gangrade 2nd year.
	3. Mr. P. C. Verma ,,

About 59 students were admitted to the 1st year. The number, though less than that of the last year, speaks favourably of the keen interest in this branch of technical pursuits. Vocational training is bound to have its day.

The novel feature of this year was that a lady student has been admitted for the first time in the annals of the College. We heartily welcome Miss. L. Paranjape amidst us and wish her every success. We hope her example will be followed by many more of our sisters in Nagpur, and the College of Agriculture will not be behind other Colleges in receiving the ennobling influence of lady students.

The hostellers seem to have determined to retain the reputation of shouldering heavy programmes. With College hours practically extending throughout the day, the determination to have. heavy social programmes bears eloquent testimony to the fund of energy which they possess. The Janmashtami festival will be celebrated with as much eclat as the Ganesh Utsava and the chief feature will be the putting on boards two dramas a Marathi play 'Lagnachi Bedi' and another in Hindi 'Rani Durgavati'. We wish the actors the success that has attended such plays in past years plus extra laurels. Art and Agriculture are closely related. If agriculture is understood in its kinship with nature the gulf between Art and Agriculture is not wide.

Due to want of funds the games cannot receive a large share of financial support this year. That does not deter our sporting spirit any the whit. Our hockey team has already recorded two victories and its final lot is cast with the College of Science—a neck to neck competition. The cricket team is also reinforced with new stalwarts and they hope to make a good show. So is the case with the football team. Energy and enthusiasm are in great evidence—a really happy augary for the future. Indoor games are very well indulged in favoured by a continuous wet weather.

The Hostel Reading Room is well attended. We hope to see more books added this year to the existing stock of books in the Hostel Library.

Under the auspices of the College Debating Society Miss R. Shah B.Ag., M. S. (Mich) delivered the inaugural address to the students of our College. The subject of her discourse was 'Citrus Industry in Central Provices and Berar'. With the aid of certain charts projected on the screen, she traced the development of orange cultivation and marketing in the Province, The lecture was highly appreciated.

Departmental News

Leave on average pay for one month is granted to Rai Sahib G. R. Dutt, Entomologist, Central Provinces, Nagpur, in extension of the leave granted to him by this office order No. 2058, dated the 13th April 1937.

* * *

On expiry of the leave granted to him by this office Order Nos. 2058, and 3129, dated respectively the 13th April 1937 and the 12th June 1937, Rai Sahib G. R. Dutt is reposted as Entomologist, C. P.

* * *

On expiry of the leave granted to him by this office order No. 2521, dated the 7th May 1937, Mr. M. S. Barker, Extra Assistant Director of Agriculture, is reposted to Hoshangabad.

* * *

Leave on average pay for nineteen days is granted to Mr. L. N. Dubey, Extra Assistant Director of Agriculture, Chhindwara, with effect from the 2nd August 1937 with permission to prefix Sunday, the 1st August 1937 and to affix the holiday on the 21st and Sunday the 22nd August 1937 to the leave.

* * *

Reviews

(1) Wheat Requirements In Europe by J. H. Shollenberger.

Technical Bulletin No. 535 of the United States Department of Agriculture, Washington, D. C.

This is a very useful and uptodate contribution to the literature existing on the subject. Informative charts pertaining to principal countries of the world which produce wheat, exports, and imports are a feature of the bulletin. The principal qualities of the types of wheat grown in Europe are discussed. The principal types of breads consumed in different countries in Europe are also described. An account of the milling practices in each country is also included. The chapter on certain economic factors affecting the European wheat requirements situation, will be very useful for students of marketing problems. The author's

general conclusions regarding factors affecting the future European demand for wheat disclose the following.

(a) Except in the Danube Basin and the Union of Soviet Socialist Republics, European wheats are predominently weak in quality and need the admixture of a considerable quantity of high protein foreign wheat in order to produce a flour from which bread of satisfactory quality can be made.

(b) The quality requirements for foreign wheat in European markets will tend toward higher levels in the future. In other words the demand for strong quality wheats will be even more insistant than in the past, with the result that price differences on account of quality will be more marked. The change to mechanized bread production now taking place in may sections will certainly bring about an increased demand for stronger wheats. The flour used must be more uniform in quality and of greater gluten strength in order to stand greater mistreatment than formerly. It is generally conceded by European millers and bakers that of the wheats of the world, North American high protein content hard wheats possess the greatest degree of dependability in baking and therefore are given preference over all others.

(c) The demand outlook for United States, Pacific North West, White wheat is not very promising. Only in the Irish Free State is white wheat especially desired. If the United States is to find a foreign market for this type of wheat it will probably have to look to the Orient.

(d) The demand outlook for durum wheat offers possibilities not enjoyed by other types for it is produced only in three or four of the countries but is needed in all of them from the production of Semolina alimetary pastes. The demand for the wheat although not great should continue to be steady.

Drink More Milk

अधिक दूध पिओ।

राग—काफ़ी

ताल—त्रिताल

स्थायी

प्रियवर सुनलो मेरी बात।
इसमें नहिं कछु तुम्हरी हानि।
बहुत भला है यह सिद्धान्त।
करि विचार देखो मन माहिं॥

अन्तरा

जो तुम चाहो सुख अरु शान्ति।
वैभव, सुन्दर स्वास्थ्य, आराम।
करो नेह तुम सब छल त्यागि।
दूध, दही, घी, मक्खन साथ॥१॥
यह सब हैं अमृत की नाईं।
रहें सुरक्षित यदि घर माहीं।
पीओ, खाओ, मौज उड़ाओ।
तुम जीवन को सफल बनाओ॥२॥
यह पदार्थ सब अति उपकारी।
जीव-तत्व मय अति सुखकारी।
नहिं गरिष्ट नहिं अपचनकारी।
इनका, सेवन सब दुख हारी॥३॥
काफ़ी चाय को दूर भगाओ।
पिओ दूध बल वीर्य बढ़ाओ।
देखो तो इसका भी ढंग।
कैसा बढ़ता बल बहुरंग॥४॥
फुर्ती आती, सुस्ती जाती।
बल बढ़ता, आयुष बढ़ती।
जिसने मानी है यह सीख।
हुई सदा है उसकी जीत॥५॥

Composed by—S. K. Misra.

The Nagpur Agricultural College Magazine

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Editorial Notes

We are glad to inform our readers that J. C. McDougall Esqr., M.A., B.Sc. (Edin.), Director of Agriculture, Central Provinces & Berar, who on account of serious illness had to go home for rest and treatment, has been recovering speedily and may be able to join duty after expiry of the leave.

* * * *

D. N. Mahta Esqr., B.A., Economic Botanist for Cotton has taken charge of the post of the Secretary, Indian Central Cotton Committee, Bombay in place of P. H. Rama Reddy Esqr., who has been appointed Director of Agriculture, Madras. We offer our hearty congratulations to Mr. D. N. Mahta and wish him success. Under his able guidance various strains of Verum cotton which are noted for their wilt resistance and textile qualities have been evolved and have been welcomed by the cotton growers of C. P. & Berar. The valuable suggestions which we hope he will continue to offer to this Province will surely enhance the prosperity of the cotton growers of this Province.

* * * *

Hiralal Shrivastava, Esqr., L.Ag., Superintendent, College Farm has retired after a long and distinguished service of 31 years. It may sound a paradox but it was perfectly true that Mr. Hirlal Shrivastava felt at rest only when he had plenty

work on the farm. The duties of the superintendent of the College Farm are many and difficult to perform. The thoroughness with which he attended to every detail of the work on the farm and the way in which he maintained his health to the last day of his service will, we are sure, serve as a brilliant example to the younger generation of Agricultural Officers.

We welcome Mr. P. D. Rane, L.Ag., who has succeeded Mr. Hirlal Shrivastava as superintendent, College Farm and and wish him success.

*   *   *   *

We offer our hearty congratulations to Dr. Gyansingh Bhatia, M.Sc., Ph.D. (London) for having obtained the Degree of the Doctor of Philosophy of the London University for his thesis on the Cytology and Genetics of some Indian Wheats.

We also congratulate Dr. Gyansingh Bhatia on his appointment as officiating Second Economic Botanist, C. P. and Berar in place of Mr. Kalkaprasad Shrivastava who has availed himself of a long leave.

*   *   *   *

Dog bites are becoming very common in Nagpur. Some people altogether treat the accident with indifference and pay the death penalty, while others unnecessarily get perturbed with the idea that they are sure to die a mad dog's death, as a result of the bite. As we had occassions when our boys in the hostel were bitten by dogs (fortunately they happened to be free from Rabies) and were not a little upset naturally, the leaflet published by the Public Health Department of C. P. & Berar on "Rabies" which has been reprinted in this issue of the College Magazine will, we are sure, be very useful. The leaflet describes clearly the course which "Hydrophobia" runs, if neglected, and also suggests how, by timely treatment, by the Medical department, one of the most distressing forms of death can be averted.

*   *   *   *

We are compelled to reiterate our appeal to our past students to help the College Magazine by becoming subscribers and by contributing articles on Agricultural Subjects. When some of the officers of the Agricultural Department met last year for the Referesher Course they ventilated their grievance that there were no facilities for them to keep in touch with the latest advances in Agricultural Science. When the matter was discussed it was pointed out that excepting a few periodicals which could be paid for by the Department and sent by rotation to the District Agricultural Officers it was not possible on account of financial stringency to arrange for a large number of costly and important magazines books etc. to be sent round as the cost of the publications and the necessary postal charges for the circulation would be enormous. One of the objects of starting the College Magazine was to supply this badly felt want and every care is being taken to amalgamate in the issues of the College Magazine useful information regarding the advances in the Science and practice of Agriculture, both in India and abroad, obtained from important magazines, periodicals, newspapers and books. Any suggestions towards the improvement of the Magazine are also welcome.

* * * *

E. A. H. Churchill Esqr., M.A., B.Sc, Principal of the College, who was on leave since February 1937 arrived last week. We heartily welcome Mr. and Mrs. Churchill admist us again.

The staff and the students of the College of Agriculture cannot forget the sympathetic way in which they were treated by J. F. Dastur Esqr., M.A , B.Sc., who in addition to his duties as Mycologist to C. P. Government also officiated as Principal during the absence of Mr. E.A.H. Churchill.

Original Articles

NOTES ON SHEEP AND GOAT RAISING

(By Dr. T. R. Kesavan, G. B. V. C., D. V. M., F. F. Sc)

The object of this article is to give all possible assistance to those who are raising sheep and goats so as to bring about a much improved type of animal, i. e. sheep giving more and better wool and convertible into more and better mutton and the raising of more and better milch goats.

Sheep and Goat.—It has been said that sheep and goats are distant cousins under the skin but it is very doubtful, since they will seldom, if ever, reproduce for the reason that they have odd chromosomes. The animals that are mistaken by some people to be crosses between sheep and goat are sometimes difficult to differenciate without examining the upper lip, which is cleft in the sheep but not in the goat. This arrangement permits the sheep to do close grazing which the cattle owners object to for the reason that their cattle have no chance on the same pasture with sheep. The sheep feeds with its head on the ground and is known as a 'grazer' while the goats, all breeds, feed by preference with head up and are known as 'browsers' This peculiarity of the goat is taken advantage of by settlers in bush country to clear their lands of scrub growth.

The Flock.—For a beginner in sheep and goat raising a flock consisting of one ram to 15 to 25 ewes is advisable, so that in case of failure the financial loss will not be great. In this way experience can be gained as the number in the flock increases. When a flock gets large, it can be split into separate bands of say 50 or 100 heads each.

Selection and Breeding of Sheep and Goats.—In some flocks of sheep one exceptionally large billy or two may sometimes be found. These should be selected and kept as sires for the flock. Other small and inferior billies should be castrated when young and sold for slaughter when they become marketable. For ewes always select fairly good-sized ones having a blocky conformation and refined appearance All scrubs and unproductive, stock should be eliminated by fattening and selling to the butcher. This procedure applies especially to those who already have established flocks that are in poor physical condition.

Another method is to buy rams—pure-breds improved—to be used in the improvement of the flocks. Rams should possess width and depth of body, active, bright eyes and should not be very old. Two or three year old rams are just in the prime for breeding purpose.

The ewes should have a roomy body, well sprung ribs, broad back, broad between hips and have a slender refined head and neck.

Fairly good breeding ewes should be placed in the breeding flock in the ratio of 50 to 30 to each ram. A fully matured ram when he is three to four years, old, and in good physical condition may have 50 ewes. When ewes are seven or eight years old they should be discarded from the flock and young ones put in their places.

A well cared ram can be used for breeding purposes continuously until he is 8 to 10 years old. Ewes should not be bred until they are about 16 to 18 months old. Early breeding generally results in stunted ewes and weak lambs.

In India ewes come in heat any time of the year and can be bred any time during the heat period. This heat period lasts from one to three days, and in exceptional cases one are two hours only. If the ewe does not become pregnant after the first service she may be in heat again within 14 to 19 days. In most cases ewes return in heat in about 16 to 17 days. In some cases they may take 21 days.

The gestation period in ewes varies, according to the breed, from 145 to 154 days. Ewes lamb once a year; twins and even triplets may be born.

To put ewes in good condition during the breeding season an exceptionally good pasture should be provided. The ram should be given a grain ration, besides an abundance of good grass.

To build up a good herd of goats the practical thing to do is to begin with say a few selected animals—one buck and two does.

A buck of good size and with a markedly masculine appearance, vigour and good conformation, should be selected for the flock sire. The buck should have a broad body, deep chest, strong back, broad hips, be low set and have short heavy-boned legs covered with long hair on the thighs and buttocks; a short thick neck with plenty of long hair, a refined head with plenty of beard, and be 'full of life'. A buck should not be used for breeding purposes until he is 18 months old.

12 to 15 are about the right number to mate with a young buck, although 25 does can be mated if he is in prime condition. With a mature buck even 40 to 50 does can be mated.

In the selection of the does the points to be looked for are fine short hair, fine neat looking head, graceful neck, well-sprung ribs and fairly long body, large udder free from indurations and pliable with well set teats. The best time to select good milking does is during the lactation period.

With goats which are always let loose at will as a general rule, bucks and does begin to breed at 5 and 6 months of age. This premature breeding however, has always a very deleterious effect on the development of the animals and their offspring. The period of gestation is 148 to 152 days. Does may kid twice a year and generally two at a time, occasionally three kids are born at one time. Goats are at their height of production when from 4 to 6 years old and may continue reproducing up to 12 or 15 years.

Continuous breeding by selection, disposal of the undersirable animals and castration of billies by the time they are three weeks old are what a goat raiser should always have in mind and practice in order to acquire a good profitable flock.

Up-grading.—Up-grading is the mating of a purebred, improved or unimproved with animals of mixed breeds or with pure-breds of another breed. It can be done by using either the male or female of the pure-bred; but it is more economical and practical to use the sire. If a breeder practices up-grading on the dam's side it will cost him more to secure a number of pure-bred females than to get one pure-bred male and up-grade from him. By up-grading the doe's side the offspring produced will have no more improvement.

A pure-bred sire imparts to his progeny of the first generation 50 per cent of his blood characteristics. When the half-bred female at maturity is mated to her sire the purity of the blood of the off-spring of the second generation increases to 75 per cent. By breeding the females of the second generation with the same sire or another pure-bred sire of the same breed the pure-blood in the third generation is increased to 85.5 per cent and so on until the sixth generation, when the percentage of pure blood in the offspring is almost 98.5 per cent and that of the un-improved blood only 1.5 per cent.

If the sire dies, another sire of the same breed should be secured to take his place in the herd or flock.

One who does up-grading work, no matter what type of animals of every succeeding generation should not allow himself to be tempted by the excellent appearance of 'high grade' males to be used for breeding purposes. A grade may look superior to his sire and the owner may be induced to mate him with the females of the herd or flock. If he does, the rapid improvement of his herd or flock stops. The superior looks are only in outward appearance. It is the purity of the blood in the sire that is so important in up-grading.

Much of the prejudice against the Indian animals is due, very largely to the result of crossing grade males with either grade or native females. The keeping of grade or cross-bred male sheep, goats and cattle for breeding purposes is the most common pitfall and downfall of livestock breeders. Such animals should not be mated, no matter how promising they may look, for the reason that they are not sufficiently full-blooded to transmit their similarity to their off-spring. After the sixth cross, preferably more, from a full-blood sire with dams equaling them in pure blood, they may, if sufficiently good in physical conformation and otherwise, be used for breeding purposes.

All grade males should be castrated before they arrive at the age of reproduction, and the earlier the better.

A good pure-bred sir for up-grading purposes, in fact for any system of breeding, with any class of animal is to be recommended in all cases. Up-grading is an economical method of livestock improvement in any country for large animal. There is more money in good grade for work or slaughter than there is in an ordinary animal and a good purebred sire produces good grades.

The work in up-grading is not limited merely to securing a pure-bred sire and to the production of good grades. Better methods of feeding and management which will be discussed later, also play a very important part. The sire, especially, should be given more attention as to feeding because he is the principal asset in the herd. The grades which are fast growing animals will not develop rapidly unless extra feed is given to them. The doe when suckling her offspring also needs extra feed to produce plenty of milk to raise her young ones.

Improved Breeds.—The term 'highly improved breed' implies that, the animals referred to have been bred up to a very high state of physical excellence and intelligence for the purpose intended. Examples are improved breeds of draft and race breeds of horses; beef and dairy breeds of cattle, the lard and bacon breeds of swine, the wool and mutton breeds of sheep, the milch breeds of goats and the meat and egg breeds of poultry. All these are the products of the skilled breeders. They are very artificial, possibly delicate in constitution, and if their breeding is not continued along a very definite direction, their special characteristics will readily become latent or completely disappear. It requires more technical knowledge and familiarity with livestock breeding and therefore close personal attention to details. It is not recommended for the average livestockman having but limited funds and little or no knowledge of livestock breeding.

Feeding.—For Oriental range of sheep and goats there is hardly any need of feeding concentrated feed when a variety of pasture grasses are abundant. For a large herd a wide grazing range is necessary. For weak, thin animals of value and for ewes and does having weak young and a deficient flow of milk there should be some concentrated feed given to them.

For a small flock of sheep it is best to have forage crops planted such as guinea grass, para grass and legumes like cow-peas and soy or velvet beans.

Goats have been seen browsing in rice fields when green paddy is 12 to 14 inches high and they select the weeds to eat in preference to the green rice plants.

Pure-bred rams and bucks should be given extra feed such as oats and wheat bran besides the local feed.

An ideal pasture for sheep and goat is one that is thickly covered with short growth grass, shrubs and bushes especially ones in or near a forest. Sheep and goats are very fond of many kinds of weeds. Rice fields would make a good pasture ground for sheep after the harvest when the soil is dry. The sheep might be brought down from the hills to feed on rice stubble and they would fertilize the land somewhat in return.

Sheep and goats will even eat the crowns of plants when pasturage is scarce and tramp the ground making overgrazed spots in the pasture, and

if allowed to remain longer they will kill the grass in course of time. It is, therefore better for the farmer to regulate his pasture by practising crop rotation.

Management.—There are many important things to consider in sheep and goat raising viz:—

(1) During the rainy and stormy season the farmer should give extra attention to his flock especially to those with young ones. They should have shelter.

(2) Infestation by parasites must be guarded against and the introduction into the flock of dangerous communicable diseases checked. It is advisable to consult your Veterinary Surgeon of the district from time to time as to how to deal with and guard against such diseases.

(3) Good pasturage, good browsing, good water and salt from time to time are necessary.

(4) Proper selection of breeding animals is necessary and a real personal interest should be taken in the animals.

(5) Sheep should be sheared annually after the rainy season in their locality.

Care of the flock.—It is a common practice to turn sheep and goats out to pasture early in the morning, but in some instances this is productive of bad results. Blot is apt to occur in the flock if they feed on certain kinds of dewy pasture, so the animal should not go into such pastures until about eight in the morning or until the sun is up and the dew is off the grass. They shuold be driven back to the shed at noon. At two o'clock in the afternoon they can be driven again to the field to stay until 5 or 6 p.m. During the dry weather a temporary shed should be built or the animals should be driven to the shade of some trees as a resting place at noon as well as night. Salt and water in separate troughs should be provided in this shelter.

Uncastrated males should not be allowed to stay in the flock. Those destined for meat should be castrated when a few weeks old.

It is best not to pasture sheep and goats in swampy areas lest they get infested with liver flukes or possibly foot-rot.

Ewes and does that have just dropped the young should be confined in pens for about a week or more until the young ones are strong enough to run with the mothers. Extra care should be given to the mothers, especially to those with weak young ones.

Care of the young.—Kids are more delicate than lambs at birth and cannot stand damp and cold weather as well for the first 4 or 5 days. Close attention is necessary to keep them dry and in a warm place.

The proper time to wean kids and lambs is when they are 4 to 5 months old.

Care of the ram and buck.—A month before the breeding season starts the breeding male should be given extra grain feed, a mixture of 2 parts oats and 1 part bran, 1½ to 2 pounds a day. For thin animals 5 parts corn 10 parts oats 3 parts rice bran and 2 parts of fine coconut cake is a good conditioning feed.

The breeding animals should not be overfat but just fat enough to keep them healthy and vigorous.

Care of the ewe and doe.—Any physical disturbances that may occur in pregnant animals may cause the death of the young and perhaps of the dam also, and consequently a loss to the owner. Therefore, during the period of gestation, which is almost five months and the development of the young, the owner should pay very close attention to his flock.

Ewes and does should be given extra grain ration if their condition is poor. Those with young require the same care until the offs-pring are 5 months old.

For a large flock of sheep a definite breeding period is more advantageous. If the ewes are bred at the same fixed time they will all drop their young at parctically the same time and all can then be taken care of more easily. It is best to start breeding in the first month of the rainy season so that the young will be dropped after the rainy weather is over and when the rainy season comes again they will be developed and so able to stand the inclement weather

Shelter.—Like other animals sheep and goats require comfortable place to take shelter in at night and during the hot and rainy days. A shed made of cheap materials should be located on high ground

and built low. A platform should be built in to serve as a resting place. Sheep and goats do not like to lie down on wet ground or wet board and for this reason it is best to keep it dry and clean at all times.

A separate pen for those with young should be provided to keep them from being annoyed by other animals. For this purpose the shed may be made into two parts—one for the animals with young and the other for the rest of the flock. Each partition should have a yard and each yard should be provided with a feed rack. Drinking trough should also be provided.

COMMON DISEASES

Foot-Rot.—This disease generally prevails in a flock that is pastured on wet ground. Sheep are very susceptible to foot-rot; goats less so. The disease is favoured by rainy weather when the ground is soft; also by insanitary corrals and environments. It usually begins at the coronary band and then small ulcers that discharge a purulent secretion form at the heels and between the hoofs. The disease may progress until the entire foot, or several of them are involved in the necrotic process. The cause of the disease is generally considered to be an infection primarily with the necrosis bacilli and the lesions are invaded secondarily by a variety of pus-producing organisms.

The successful treatment of the foot-rot may be extremely obstinate. It would be advisable to separate the affected animal, or animals, from the non-infected ones, for convenience in treating them and lessening the danger of the disease to the non-infected animals. The corrals in which the animals are kept should be dry and clean at all times and the flock pastured on high and well drained land during the rainy season.

Treatment.—Keep all disease borne pared off closely at all times and the feet as dry as possible. Refined oil of pine tar containing about one per cent of formal dehyde or 4% carbolic acid may be applied once daily with a swab. Or the affected parts may be swabbed once daily with from 10 to 20 percent methylene blue solution in water. A weak rubá root lotion with 10 to 15 per cent vineger or about 2 to 5 percent solution of glacial acetic acid may also be tried.

Worms.—Sheep and goats are generally subject to worm infestation if the flock is continuously kept in the same pasture year after year. Sheep and goats raisers should, therefore, rotate pastures.

There are several varieties of stomach and intestinal worms in sheep and goats, but as the same treatment will answer the purpose for most of them they will not be classified as to variety.

If they are infested with stomach or intestinal worms in such numbers as to be deleterious to their health, they will present signs of a progressive unthrifty appearance. The hair loses its natural gloss, the visible mucous membranes are pale and the animal may have attacks of colic from time to time. If the worms are in the intestinal tract there may be a looseness of the bowels possibly mixed with blood amounting to an actual diarrhœa. A positive diagnosis is made by examination of feces under microscope or by post-mortem.

The effective method in control of parasites is to combine pasture rotation with drug treatment, i. e. placing only a small flock instead of a large one in the pasture if it is possible to do so.

For stomach worms (Haemonchus Contortus), One per cent Copper Sulphate solution alone or with one per cent by weight of tobacco solution can be tried. Dose is (Copper Sulphate sol. 1%) 2 to 3 ounces for adults and 0.5 to 1 ounce for lambs and kids. The treatment should be repeated at intervals of three to four weeks for about sixmonths.

For intestinal worms-Cu-nic solution can be tried. The solution is made by mixing one ounce of a 4% nicotine sulphate solution in one gallon of one per cent Copper Sulphate solution. The doses are the same as for Copper Sulphate solution.

Carbon Tetrachloride solution is fairly efficient in single doses against stomach worms and hook worms. The doses are 10 to 30 m. m. for lambs and kids and 30 to 50 m. m. in capsule for adult sheep and goats.

Liver Fluke.—The main source of fluke infestations is a swampy land, ponds, streams, and creeks where snails abound. The snails serve as hosts for the embryos and the water as a factor in the life of fluke eggs.

An animal may be infested by eating grass to which the flukes may have attached themselves and by drinking water in which young flukes may happen to be floating. These get into the bile duct where they lay eggs by the thousands. The eggs pass out with the dung and when

dropped into the water they hatch and the young flukes look for snails for further development. From the snails these embryo flukes attach themselves to the blades of grass that may be growing in the swamp.

Animals infested with flukes become weak and emaciated and the membranes of the eyes and mouth become pale.

Treatment is of no use. It is best to drain the infested area and thereby kill all the snails or keep ducks in that area so that they will swallow the snails or to fence in the fluke-infested area to prevent sheep from getting into them.

Gid.—(Turnsick) This is a parasitic disease caused by a tapeworm Cyst (Multiceps or Coenurus cerebralis.)

The eggs of this tapeworm are scattered about in the feces of infested dogs and when swallowed in food or water by sheep or goats, hatch out and the embryos migrate to various parts of the animal's body including the brain, where they may develop into cysts. Dogs are infested by eating the raw meat of the animals that may be infested with cysts that develop into mature tapeworms in their intestines and thus another life cycle of the tapeworms may be started.

If the cysts form in the brain of an animal they will cause brain disturbances characterized by the animal holding its head to one side and walking round in a circle; hence the name 'Turnsick.'

There is no cure for this disease. The most practical way is to butcher the animal and burn the brain, the intestines and other infected parts to prevent the spread of the disease.

Mange (Scabies).—This disease is easily noticed on animals, as the hair or wool comes off in patches, caused by the continuous scraching by the animal when the parasites are active about the hair roots, sucking the blood of the victim. There are several varieties of the Manage mite that may affect the sheep and goats.

Animal so affected should be clipped before any treatment is given. This facilitates the penetration of the medicine into the skin.

Lice.—Lice are very common on goats and to a less extent on sheep. They cause constant irritation and a resulting loss in physical condition.

Any of the standard coal-tar dips will readily destroy lice and to a great extent mite. A very convenient coal-tar preparation is known as 'Kerso Dip' No. 1. It may be used in the proportion of one part of the dip to 75 parts of warm water. The animal should be completely immersed in the solution or otherwise saturated to the skin.

Other Diseases.—Goats are possibly hardier than sheep and are not very susceptible to tuberculosis. But they are equally susceptible to most infectious diseases of cattle in India such as Anthrax, Hæmorrhagic Septicemia, Rinderpest and Foot-and-mouth disease.

It is always safe to arrange with a Veterinarian to have your flock's periodical inspection and professional advice.

Uses of sheep and goats.—Sheep and goats are widely disseminated in the world and many countries make varied and profitable uses of them.

Mutton is regarded as an excellent meat in Europe and America. It is easier to produce than beef and it is dearer in the local markets.

Wool has always demand and there is no slump for good quality in Europe and Japan.

Hides. The hides are used in the manufature of shoes, gloves and parchment. A good sized sheep or goat skin costs from three to four rupees. The United States alone uses about 50,000,000 goat skins annually and a part of this is going from India.

Goat's Milk.—Goats are very rarely affected with turberculosis, their milk having an advantage in this respect, over cow's milk. Besides that, goat's milk differs materially from cow's milk in several respects, Viz :—

1. It has smaller fat globules and is a more perfect emulsion.
2. The fat globules will not always separate readily from the emulsion and come to the surface forming what is known as cream as with cow's milk.
3. Goat's milk is alkaline while cow's milk is acid, in reaction.
4. The curd formed in the stomach by the action of certain gastric juices, from goat's milk is smaller and not as tough as that formed from cow's milk.

Goat's milk is generally preferred to that of cow's milk for the following uses :—

1. For infant feeding.
2. For gastric hyperacidity in adults.
3. For persons affected with tuberculosis.
4. For general mal-nutrition or for impoverished physical conditon in general.

Besides furnishing goat milk, mutton, wool and hides and being useful in clearing agriculture land and road sides, sheep and goats furnish also some other important by-products.

Strings for violins also come from sheep by-products. Certain kinds of gelatines and paste and fertilizer are also produced. The bones are made into bone meal for poultry and into household articles. The internal organs are made into fertilizer.

Comment.—Sheep and goats multiply rapidly, mature early and can be raised on land that will not support any other kind of domestic animal and many more of them can be easily raised within short period and with very limited funds.

There are enormous areas of tree-less but grass covered lands particularly in the hilly regions of North India that would carry goats, and in the higher altitudes, it is believed that a very good combination of mutton and wool-producing sheep could be raised successfully. If so it would open up an unexploited livestock industry in India having enormous possibilities on otherwise more or less valueless land.

A SCHEME OF RURAL RECONSTRUCTION

J. L. SEN, B. AG.

Introduction.—The expression 'Rural Reconstruction' is a vague one and demands for its success the organised efforts of different nation building departments. Though strictly speaking, I should restrict my attention to a portion of the wide problem; still the general welfare and prosperity of rural population are not outside the purview of myself and the department of which I am a spade-worker. No doubt I am a technical man, supposed to serve the public with my technical knowledge and guidance; but technical advances alone cannot pull rural India out of

her present ruinous situation. The following lines of Mr. W. H. Moreland go to substantiate my statement.

"It may be affirmed with confidence that the welfare and the prosperity of rural population will not come through technical advances alone; if it is true that better living can be secured by a combination of better farming and better business, it is equally true that the will to live better must furnish the driving power that is required; at the heart of the problem lies the development of desire for a higher standard of living."

With this explanation I am trying to tackle the entire problem of rural reconstruction as far as my capacity permits me.

Organisation.—It is an unquestionable fact that proper organisation is an indispensable preliminary to the successful working out of any scheme. The scheme for rural reconstruction which I am presenting is no exception to the general rule. So I propose the following organisation for this.

A wholetime officer should be specially deputed for the development work of each commissionary. A number of rural Boards, Panchayats or village authorities whatever they may be called should be constituted and placed under him. The area to be served by a Board must be a village or a convenient village-group. The attention should be first concentrated on a few selected villages. If the development work can be successfully carried out in these villages, then it will be imitated by the neighbouring villages. The personnel of a Village Board must consist of representatives from the village communities within its jurisdiction and the members nominated by the Govt. Such a Board must be assisted in its work by the attendance of the officers of various departments concerned with rural development namely, Educational, Agricultural, Sanitary etc. The development work within the jurisdiction of a Board must be financed partly by public subscription or taxation which-ever may be convenient and partly by a Central Board which must be constituted by centralisation of all subordinate rural boards in a commissionary. The personnel of a Central Board must consist of representatives from different Panchayats and the members nominated by the Govt. The necessary fund of the Board should be raised by subscription from different subordinate Boards and Govt. grant. The function of a Central Board must be the distribution of funds to subordinate Boards and directing them in their work.

It must be implanted in the mind of rural population that the

Government subsidy either in the form of kind or in the form of coin can only supplement but cannot substitute self-initiative and that Govt's help is rendered in proportion to the people's power of helping themselves.

The working of Rural Reconstruction.—The main features of Rural Reconstruction are (1) Education (2) Public Health and Sanitation (3) Communication (4) Economic Regeneration.

I am going to tackle these one by one.

Education.—It should form the feature of Rural Reconstruction. All social reforms, leading to rural reconstruction largely wait upon literacy. So special attention should be paid for the spread of education.

In each of the selected villages, Primary Education should be made compulsory for boys and girls by suitable by-laws. In such a School along with the teaching of three R's, agricultural activities, in the form of school gardening, and industrial activities should be undertaken. The boys of higher classes should be given some idea about rural sanitation. Hygiene should be taught in every stage of school life.

In these days of wide franchise, when the voting power has been extended to all those who are literate, it is highly desirable that at least the boys of the higher classes, who are the future electorates, should have some acquaintance with the administrative machinery.

The boys of the higher classes should be given some training about Citizenship. My experience with people has disclosed a very pathetic fact that every citizen thinks that it is the concern of the State to ameliorate his condition. He seeks state-help even in such matters of private interest as clearing of Water Hyacinth in his own land. Thus the craving for state-help has crimpled the millions of our rural population who have brought the healthy practice of self-help to disuse. Rural reconstruction largely demands the resuscitation of citizenship in the true sense of the term. Thus elementary Civics should form a part of the curriculum for boys of the higher classes in schools.

Education, in Public Health, Rural Sanitation, Citizenship etc should go side by side with Primary Education. and can be conveniently carried on through clubs, films, and magic lanterns.

The teacher who will be in charge of primary education should manage adult education also. But this implies the employment of a

young man of fairly high liberal education. Such a teacher should be trained in rural reconstruction for about three months and in first-aid treatment for another three months so that he may be a village-doctor for minor ailments. The latter training can provide an easy source of medical help and guidance to the rural population. In this connection, I may recall the practice followed in the Bombay Presidency where a number of Primary teachers are given training for about two and a half months duration in Civil Hospitals in what may be called "first-aid." At the end of the course they return to their schools and act as first-aid doctors in the vicinity. This has proved a great success in the Bombay Presidency. During the first six months the scheme was in operation these teachers dealt with over 120,000 cases and Collectors, Civil Surgeons and the Presidents of Municipalities and Local Boards have borne testimony to the quality and the value of the work. Assured by the success of the scheme in Bombay, I am advocating very strongly it's introduction in Assam.

The movement for rural reconstruction will not gain power for good if it fails to develop a women's side to it's activities. It has been rightly said that "the hand that rocks the cradle builds the nation".

For the female education in these selected villages I propose the introduction of almost the same system as has been advocated in case of male-education. Only general knowledge of midwifery and home-nursing should replace Agriculture and School-gardening and also industrial activities should cover designing, embroidery, and other female handi-crafts. Such industries can provide spare-time employment to females and bring an additional income to supplement the income of male members. In connection with female education, one thing I must mention that, by these female teachers or guides whatever they may be called, active propaganda should be carried on for awakening public consciousness of, and the appreciation of appalling wastage of infant and maternal life that results from the terrible rigours of child-birth.

A female teacher like her male colleague for Primary boys School should be given some elementary training in female diseases. In short, she should perform the same duty in the female circle as her male colleague will do in his own circle. Thus the scheme for female education also implies the employment of ladies of fairly high liberal education along with some training in rural reconstruction, female handicrafts, nursing, midwifery and first-aid-treatment for minor female-diseases.

For the general education of the public, a journal containing Articles on Co-operation, Agriculture, Public Health etc. along with the current news should be edited and published from each valley in such a language and manner as can be easily intelligible to the half educated rural masses.

Public Health and Sanitation.—To prevent unhealthy drainage and indiscriminate disposal of household sweeping and other refuses, providing a nice shelter for mosquitoes, and other unhygienic practices, act should be introduced by the Govt. and operated through village-Panchayats.

For other sanitary arrangements, the State may provide technical advice, and staff and assist with money. But carrying out of schemes in details must be a matter for people themselves.

Active propaganda through films and lantern lectures should be made for medical education. Until and unless the people themselves are convinced of the desirability of maintaining themselves in sound sanitary and healthy conditions, no amount of medical help and relief can come to the rescue of this dying nation. The creation of a determination to protect wells and to keep the villages clean and to avoid as far as possible the pollution of drinking water will lead to an enormous improvement of public health.

In view of the fact that most of our common diseases are spread through the consumption of polluted water, it is highly desirable that better provision should be made for the supply of good drinking water. The state should undertake the repairing of old tanks in the selected villages on the stipulation of the observance by the villager of the rules and regulations that will be imposed for maintaining the purity of water. Such a tank will serve the need of neighbouring houses, or even villages. Besides this, the Govt. should advance loans on easy terms for repairing old tanks The Govt may well regard the expenditure on capital works of the nature described above as constituting a sound policy of insurance against diseases carried through the drinking of polluted water.

Communication.—To extend the facilities for easy communication a general survey will have to be made. In this matter the interest of village groups should be created so that the villagers may contribute something in the form of cash money, or labour. The state should provide

only the technical advice and staff and assist with money grant but the rest should be the concern of the villagers themselves.

Economic regeneration.—The following factors will contribute to the economic regeneration of the rural population: (1) Relieving the poor cultivators from the crushing burden of debt. (2) Discouragement of unnecessary wastage in social and religious customs and ceremonies. (3) Discouragement and minimisation of the expenses on litigation. (4) Supplementing the present income of cultivators with the income from sparetime-employment.

Relieving the poor cultivators from the crushing burden of debt.—To save the cultivators from the ruinous extortion of the unscrupulous money-lenders, Debt Conciliation Boards which are already on foot in several Provinces should be brought into operation in Assam also. This will secure a lot to the cultivators' bankrupt fund. Land Mortgage Banks should be constituted more and more to provide cultivators enough money to set off their old debts carrying an exorbitant rate of interest.

To finance Agriculture and Agriculturists, the loans from Co-operative societies, Tacavi loan, and Agriculturist's loan from the Government should be extended more generously. Discouragement of unnecessary wastage in social and religious customs and ceremonies, can only be achieved by educating public opinion and consequently largely waits upon the spread of education. If the policy of education as has been suggested by me be brought into practice, such wastage will soon become obsolete.

Discouragement and minimisation of expenses on litigation.—To discourage litigation on petty matters which are stealing a lot from the exhausted resources of a cultivator, the lowest limit of the cost of a suit, worthy of being accepted by a court of law should be raised.

To minimise the expenses on litigation every case must be tried first by Panchayat so that enough scope may be provided for settling disputes without paying the expenses, demanded by the elaborate court procedure. The government courts should not accept any case unless it is tried first by the Panchayat.

Supplementing the present income of cultivators with the income from sparetime-employment.—Along the betterment of general farming, the following subsidiary occupations should be introduced and encoura-

ged to supplement the present income of cultivators. (1) Sericulture. (2) Apiculture. (3) Fruit culture. (4) Pisciculture. (5) Culture of culinary vegetables. (6) Poultry-farming. (7) Dairy-farming. These occupations can be taken up by cultivators without losing their identity as tillors of soil who as a class constitute more than 70% of the population of Assam. Every attempt should be made for the industrialisation of Agriculture on the scale of cottage industry. The details of the schemes for the introduction of these subsidiary occupations lie beyond the scope of this short paper.

Let me now sum up my suggestions for rural reconstructions on the following lines:—

(1) A number of villages should be selected from each commissionary and placed under a development officer, working through the properly constituted Village Boards centralised into a Central Board.

(2) One male and one female teacher should be specially trained for spreading education in the selected village or a village-group.

(3) To improve sanitation and public health there should be a Rural Sanitation Act and the necessity for the supply of good drinking water and medical education demonstrated through films and magic lanterns.

(4) To improve communication, the State should provide proper technical advice, expert suggestions and money grants but actual work should be the concern of the villagers themselves.

(5) By creating Debt Conciliation Boards and by providing loans on easy terms, cultivators should be relieved from the crushing burden of debt. Loans should be advanced to finance Agriculture.

(6) To Discourage litigation on petty matters, the lowest limit of the cost of a suit, acceptable to a court of law should be raised.

(7) To minimise the cost of litigation, every case must be tried first by the Panchayat of the locality so that scope may be provided for settling a dispute without paying the expenses for the elaborate court procedure.

(8) To supplement the present income from land, introduction of the following subsidiary occupations should be specially stressed on. (a) Sericulture (b) Apiculture (c) Fruit-culture (d) Culture of culinary vegetables (e) Poultry- farming and (f) Dairy-farming.

THE CENTRIFUGAL PUMP

(CHITARE, B. E.)

The centrifugal pump, one of the simplest of machines mechanically, has, because of its merit, become one of the most used appliances for moving liquid, and there are few pumping problems to which it has not been applied.

In recent years its efficiency has been brought up to such a standard, that, taking into consideration the first cost, not only of the machine itself, but also that of foundations and installation, it has become more than a formidable rival to the high duty reciprocating pump.

It has so wide a range that it would be difficult to find any duty it has not been made to perform, with sizes ranging from $\frac{3}{4}''$ to $102''$.

Besides the usual small pumps for general purposes such special work, has to be dealt with as :—

Docks.—requiring dewatering and impounding.

Sewage installations.

Drainage and irrigation works of all sizes.

Dredger equipment, ranging from the large sea-going boats which clear the sandbars and deepen the harbours of great ports, to the smaller sets used for the clearing of rivers and lakes, working gravel pits, and reclaiming land. All the foregoing work at low or moderate heads.

Dewatering mines, with heads up to 3000 feet.

Waterworks installations.

Boiler feed pumps and hydraulic service.

In proceeding to describe how this useful machine performs its work, we will first of all consider the difference that exists between the centrifugal pump and the ram pump as this tends to emphasize a most important principle.

Ram Pumps.—The Ram Pump is a displacement pump. In the space vacated by the one outward movement of the ram a partial vacuum is formed, and as nature abhors a vacuum, air or water will flow in through the suction valve under pressure from the atmosphere.

It will be observed that the pump can handle air, as well as, water.

The ram returning expels the charge of fluid out through the delivery valve, repeating the cycle as long as required.

The points to note are :—

That air can be dealt with and so, by exhausting the suction pipe of air, the water follows in due course.

That the fluid is dealt with in separated sections. Each time the plunger is raised the liquid fills the barrel, and is then isolated from the following liquid by closing the suction valve.

Centrifugal Pump.—Now let us look at the centrifugal pump. Here is an entirely different machine.

Three main differences are obvious, viz :—

1. A rotating part is the main feature as against the reciprocating action of the ram.

2. What valves there are remain open while the pump is in operation, instead of opening and closing for each revolution or cycle.

3. A different means of collecting the water and conveying it to the discharge pipe is employed.

Then how does this type of pump get started ?

It is essential to provide an unbroken column of water on the suction side, from the water level to the well above the entry to the impeller.

That column is put in motion by the rotation of the impeller and is maintained in motion in one continuous stream.

The impeller is revolved at a speed suitable for the head it has to overcome; the vanes at entry pick up the water, passing it through to rim and so induce a flow, the speed of which increases as it nears the outer diameter where it is thrown off. The water is then collected, slowed down again to a reasonable velocity for transmission through the discharge pipe; but with this great difference, that having received power in the form of speed the slowing down is done in such a way that the

velocity given up remains in the water in the form of pressure, and is available for overcoming the head against which it is desired to pump.

It will be noticed that the following points are of importance:—Starting at the end of suction (which must be submerged to such a depth as will prevent cavitation, at least two diameters of the pipe.)

1. If a foot-valve is used it must be of the full-way type giving the greatest free area for passage of the water.

2. The suction pipe should be of such a size that the loss by friction is reduced to as low a figure as possible, considering cost.

3. The suction passages in the pump must be amply designed for the same reason.

The entry to the impeller must be so designed that the water flows in with as little disturbance as possible at its change from straight to rotary flow.

5. The flow through the impeller must be without shock.

6. The discharge from the impeller, and collection of the water as it leaves the impeller, must be as smooth as possible, and due care must be given to the conversion from the high speed at the impeller rim to the slower speed at the pump discharge.

It is at this stage we might absolve the Centrifugal pump from being the simpler machine that it appears to be at first sight.

We find that each and every one of the points mentioned are variable, and each variation can make a profound alteration to the performance.

It follows that there are, apart from external fittings such as bearings, shaft and pipes, two main parts to consider :—

1. The impeller which is the heart of the machine and imposes the power supplied to it on to the water.

2. The casing which provides the entry passage and the collecting device, two forms of which are used, the volute and the guide ring, both with their advantages and disadvantages.

Taking the impeller first:—

Gibson in his 'Hydraulics' describes its operation as follows:—

"The rotation of the impeller produces a forced vortex in the contained water with consequent increase of pressure in an outward radial direction and a tendency to outward flow. If the speed of rotation is sufficiently high, this increase in pressure becomes more than sufficient to balance the pressure of the delivery head and flow takes place. A partial vacuum is produced at the centre of the impeller and water is forced up the supply pipe by atmospheric pressure."

Now a vortex can be of two forms, free or forced. If you have watched the water in a basin disappear on pulling out the plug, you will have noticed that it tends to spin and form a funnel. This represents a free spiral vortex and the important thing to observe is that the head from a datum of the bottom of the basin is greatest at the outer edge, and that as the centre is approached this head gets less and the velocity of the water is increased. If on the other hand we spin the water in a confined space between two surfaces by some mechanical means, we reverse the process and the rotary motion produces a head at the outer edge. We then have a forced vortex.

The application of this principle to the impeller of a centrifugal pump takes the form of a combination of these two, and we get the forced vortex from the centre due to the impeller and immediately the water reaches the outer rim it is discharged as a free vortex and is gradually slowed down in the space outside, converting the velocity into pressure to overcome the head.

Again place some water in a can; revolve the can at a good speed, and we find that, though we did not fill the can more than half full if we spin fast enough we shall spill the water over the top.

In other words we have a forced vortex.

Put a lid on the can having filled it with water, and we shall on spinning equal to the height the water would have risen if no lid had been on. If we now punch holes in the sides of a can, water would be discharged through them at a velocity equivalent to the pressure inside and would continue to do so if some means were arranged to supply water to the vessel continuously.

Should we put into the can a set of blades, revolving these instead of the can itself, we would find the effect the same, and we should have approached very nearly to the general type of a centrifugal pump as far as the impeller is concerned.

(To be continued).

CULTIVATION OF GHUIYA OR ARUM

DHANNALAL

Natural Order.—Aroideæ.

Botanical name.—Colocasia Antiquorum.

Description.—Ghuiya is propagated from and valued for its underground stem which is botanically known as corm. The short internodes and the minute scales are very distinct in this case. There are many buds called eyes on the solid and erect subterranean stem which help the grower in propagating it vegetatively.

Importance.—The gardeners of all provinces in India are interested in the growing of Ghuiya. In the U. P. the growing of Arum has been of great commercial importance since long. Large areas are devoted to this crop in those provinces and in the Punjab. In the C. P. too it is generally grown round about cities and towns.

Soil.—The main requirement of Arum is a well cultivated friable soil that will permit of maximum corm development. Under such conditions the crop grows well on loams.

Manure.—Twenty to twenty five cart-loads of Farm Yard Manure are added and well mixed with soil at the time of preparatory tillage. Besides Ammonium Sulphate 140 lbs, Superphosphate 200 lbs and Potassium sulphate 80 lbs should also be mixed and applied per acre before the layout.

Cultivation.—The land should be ploughed deep and bakhered a number of times to get fine tilth up to a depth of 6 inches. After thorough preparation of the land, the surface is levelled with a planker and then it is ridged up either with the E. T. plough or by hand labour 9"—10" high. The ridges should be 24" apart the furrow being as deep as possible. The plough is then run at right angles to the ridges to form parallel

water channels 12' apart. Finally the field is laid out into beds 12' square. If the ground is uneven the size of the beds may be reduced accordingly. Each compartment when complete contains 4 short ridges and furrows.

Sowing.—The seed from the last harvest is generally stored for sowing the new crop. After sorting out the rotten diseased and mechanically bruised and injured corms, the good seed is sown at a rate of about 800 to 1000 lbs per acre. The bigger corms are broken into smaller ones taking care that each set contains at least 2 healthy buds. The sowing is done at the depth of about 3 to 4 inches in the month of June at a distance of 9 inches from set to set in the middle of the furrows.

After-care.—Weeding is necessary in the early stages of growth but once the plants become established, the well developed leaves thus formed will prevent weeds growing in any appreciable quantity. About 2 to 3 weedings are required during its growth. Earthing is very essential to obtain a good yield. The ridges are broken and the soil heaped round the base of the plants so that what were originally furrows become ridges and what were ridges ultimately become furrows.

But if the soil is very stiff then it is advisable to plant the arum along the shoulders of the ridges maintaining a spacing of 9 inches between plants alternating on a ridge. Earthing is difficult when planting is done on the sides of the ridges. Corms if not completely covered by soil become long and stick-like instead of being round and fleshy.

Watering.—Ghuiya requires no water during the rains but it generally receives 2 to 3 irrigations after the rains.

Harvesting.—When the leaves get paler and begin to fall down the crop becomes ready for harvesting. This state is reached during the months of October or November. The operation of harvesting consists in the removal of the leaves and then digging up the corms with the help of forks or kodaly.

Outturn.—The yield varies from 8,000 to 10,000 lbs per acre.

Arum meant for planting in the ensuing season is left unharvested till the leaves dry on the field. The whole plant is then carefully lifted and stored in a cool place. The corm should neither be washed nor the adhering roots removed.

The cost of cultivation of Arum crop per acre on the College Farm, Nagpur.

(i) **Manuring:—**		39 12 0
(a) Cost of 25 Cart—loads of F. Y. M. @ Rs. 1/8/-	37/8/-	
(b) Spreading charges 12 women @ /3/-	2/4/-	
(ii) **Preparatory tillage with bullocks and iron plough :—**		5 6 0
(a) 2 pairs of bullocks @ Rs. 1/8/- per day	1/8/-	
(b) 3 men @ -5/- per day	-/15/-	
(c) depreciation and (interest Area ½ an acre.)	-/4/-	
(iii) **3 Bakherings:—**		2 2 0
(a) 1 man @-/5/-		
(b) 1 pair of bullocks Area 1½ acres. -/12/-		
(iv) **Fetilizers :—**		22 3 6
(a) Ammonium Sulphate 140 lbs. @ Rs. 5/1/- per md. Rs.	8/13/9	
(b) Superphosphate 200 „ „ 3/12/- per Cwt. „	6/11/3	
(c) Potassium Sulphate 80 „ „ 8/-/- per Cwt. „	5/11/6	
(d) Spreading charges 5 women per day @-/3-	-/15/-	
(v) **Opening furrows with an E. T. plough and making beds and Channels:—**		
(a) 2 men @ -/5/-	-/10/-	3 4 0
(b) I pair of bullocks	-/12/-	
(c) 6 men to mend	1/14/-	
(vi) **Cost of seed:—**		62 8 0
1000 lbs. @ 16 lbs. per rupee.		
(vii) **Planting:—**		8 12 0
(a) Sorting sets 5 women @ -/3/- Rs.	1/14/-	
(b) Digging pits or making holes 10 men @ -/5/-	3/2/-	
(c) Planting sets 20 women @ -/3/-	3/12/-	
(viii) 3 **Weedlings:—**		6 12 0
12 women per acre @ -/3/- Rs. 2/4/-		
(ix) **2 Irrigations by Persian Wheel:—**		5 8 0
(a) 2 men @ -/5/- each Rs. /10/-		
I pair of bullocks -/12/-		
Area ½ an acre.		
(x) **Harvesting:—**		11 3 0
(a) Cutting and removing leaves 8 women @-/3/- Rs.	1/8/-	
(b) Digging corms 25 men @ -/5/-	7/13/-	
(c) Cleaning 10 women @ -/3/-	1/14/-	
(xi) **Land Revenue:—**		5 0 0
(xii) **Watching charges:—**		2 14 0
(1 man for 2 months for 7 acres @ Rs. 10/- per mensem.)		
Total		174 4 6
By sale of 10,000 lbs. of Arum @ 40 lbs. per rupee		250 0 0
Net profit		74 11 6

Extracts

UTILISATION OF MOLASSES

Acuteness of the Problem,

By V. Subrahmanyan, D. Sc , F.I.C.,

(Department of Biochemistry, Indian Institute of Science, Bangalore).

During the past few years, a great deal has been said and written about the utilisation of molasses, the chief by-product of modern sugar industry. A large volume of research work has been done on the subject and a number of suggestions made for the conversion of molasses into articles of utility and value. Unfortunately, many of these offer several practical difficulties or are otherwise unworkable, so that a considerable part of India's output of molasses has now become a drag on the market and has to be either accumulated indefinitely or disposed off at considerable trouble and expense to the producer.

The problem of molasses is not unique to India. It is common to all the major sugar producing countries—Java, Cuba, Queensland, Natal, Mauritus, Hawaii and such others—and, judging from the available literature they are all experiencing considerable difficulty in utilising the entire output of molasses. It would be quite appropriate, therefore, to review the present position and to consider certain useful lines of future development.

Need for Greater Efficiency.—It is well known that the average molasses contains quite a considerable amount of cane sugar (sucrose). The percentage of sucrose is variable (from about 30 to over 50), depending on a number of factors at least some of which can be adequately controlled. By reducing the quantity of sucrose in molasses, say by 20 per cent, there greater recovery of sugar and consequently, less difficulty in regard to will be the disposal of molasses. This aspect of the problem has not yet been satisfactorily dealt with and it is common knowledge that the yield of sugar (in proportion to the cane crushed) from most factories in India is much less than in other leading sugar producing countries.

There are a few well-known methods for the recovery of cane sugar from molasses. Among these, the best known is one involving the conversion of sugar into lime salt (by suitable addition of milk of lime) and its subsequent treatment with the carbonic acid. This will result in

the separation of the carbonate of lime and the passage of free sugar into solution. Although it is theoretically sound, this process is not, however, so simple as it appears. The separation of other sugars and undesirable salts must first be effected. The lime salt (which is sparingly soluble) has to be treated with a large volume of water, so that the resulting sugar solution is very dilute. There are also other difficulties, so that the process though otherwise feasible, is rather expensive.

Conversion of Molasses into Human Food.—A number of suggestions have been made for the utilisation of molasses in the manufacture of confectionary and other articles of human consumption. The chief drawback appears, however, to lie in the presence of bitter or otherwise undesirable salts which have to be first removed. Another defect is the presence of excessive amount of caramel and other organic impurities, which impart undesirable colour and taste to the product. No satisfactory method has, so far, been evolved for the removal of these impurities and as commercial glucose—which is more suitable for the manufacture of confectionary—is now cheaply available, the chances of molasses in this direction seem to be rather remote. Recently Dr. A. V. V. Iyengar, working in these laboratories developed an elegant method for the removal of potash which is the chief mineral salt in molasses. The residue has a greatly improved taste and it is possible that with a few similar treatments, a considerable part of the other undesirable components, can also be removed.

A convenient way of dealing with molasses, and one which is still practised in many parts of the country, is to mix it with low grade cane sugar and to convert it into a form of jaggery. The product has an unattractive appearance and does not keep well. It can he sold only at a very low price and it is doubtful whether its manufacture will pay in the long run.

Conversion into Animal Food.—Several investigators, both in India and abroad, have tackled this aspect of the problem, but the position is still rather vague. All workers admit that farm animals can be made to eat molasses if it is suitably admixed with other types of feed. Many have also worked out recipes suitable for their localities. It is difficult, however, to make out whether the animals want them in preference to their normal feeds: indeed some workers incline to the view that the animals do not care for them when the usual fodder is available. A further difficulty lies in the fact that feeds treated with molasses absorb moisture and undergo rapid fermentation, thus spoiling the entire product.

Systematic work—spread over a few generations—on animals is also needed to determine whether the abonormal quantities of mineral salts present in molasses have no adverse effect on animal system. It is possible however, that molasses will serve as a good starter for silage. Excessive quantities should be avoided as it will make the product very intensively acid. The fermentation which will be vigorous will also require very careful control, especially in regard to the air supply. Some work in this direction is already in progress and the practical results are awaited with interest.

II

Its value as a fertilising agent.—It is well known that when admixed with lime and certain other substances, molasses turn into a semi-solid mass which can be worked out into various articles of utility and value. A few attempts have been made in Europe and America to commercialise this process, but unfortunately the resulting products are inferior—both in regard to the finish and utility—to those made out of synthetic resins, which are now cheaply available. Moreover, the plastics prepared out of molasses are not resistant to more than moderate heat and are slowly attacked by water, so that they do not appear to have much chances of competing successfully with the other products on the market.

The plastic properties of molasses are being successfully applied in road making, especially in the neighbourhood of sugar factories. Recently, the progressive Mysore State tried it out on an extensive scale and considerable part of the present road from Bangalore to Mysore has been "tarred" with molasses. The surface of the road is very smooth, and resembles one made up with asphalt. It is also said to keep well. If this observation can be generally borne out and transport facilities are cheaply available, then, molassing of roads will be an elegant way of utilising the products.

Manufacture of Power Alcohol.—There is extensive literature on this aspect of the problem. Much has been said and written both for and against this method of utilisation. Taking all the known facts into consideration, it may be stated that molasses can be easily fermented by yeast, the conversion of sugar into alcohol and carbonic acid being nearly as high as 90 per cent of what may be theoretically expected. The subsequent concentration of the dilute alcohol into a nearly absolute product (about 98 per cent) can also be easily effected at fairly low cost (slightly

over 4 annas a gallon). It has also to be admitted that absolute alcohol, which is completely miscible (mixable) with petrol can be safely added to the extent of about 30 per cent and the mixture used for all types of internal combustion engines for which petrol alone is now being employed. There are a number of difficulties, however, in the way of the commercialisation of the process, the chief one arising from the circumstance that the producers of petrol and alcohol are different people. The centres of production are very distant from each other and it is very doubtful whether even with compulsory legislation, the price of the mixture will be appreciably less than that of petrol alone. Indeed, the present cost of oil-mining is so low that even pure petrol can easily compete with alcohol in the country. A further difficulty associated with the alcohol industry is the necessity for rigorous excise supervision, which may make the process highly expensive. These difficulties have, of course, been overcome in certain parts of the world and if the Government of India can introduce a legislation enforcing the distribution of petrol admixed with a certain percentage of alcohol or can so adjust the duty as to facilitate substantial reduction in the price of the mixed product as compared with petrol alone then there can be some reasonable hope of the alcohol industry making headway in this country. The intervening obstacles are, however, so many that it is difficult to imagine any useful development in the near future. In the meantime, molasses will go on accumulating in most of the factories and unless some other immediate use is found for it, the disposal will soon become a serious problem.

Molasses as Fertiliser.—It is generally recognised that molasses contain the major part of the nitorgen and minerals that the plant had originally removed from the soil. Added to that, it contains an extra quantity of lime and a considerable amount of fermentable matter which rots readily in the soil, resulting in a number of useful products. There is also evidence of fixation of atmospheric nitrogen by the soil bacteria, so that molasses would make an all round fertiliser. Field experiments conducted in Java, Queensland, Hawaii, Natal and elsewhere have shown that under the soil conditions prevalent in those countries molasses make a good fertiliser to both sugarcane and rice. Recently Prof. N. R. Dhar and his associates at Allahabad have taken up this systematically and have shown that striking increase in crop-yield can be obtained through application of molasses as fertiliser. They also showed that alkaline soils can be at least temporarily reclaimed through application of molasses. The chemistry of the related process have recently been worked out at

Bangalore, Allahabad and elsewhere and there is no doubt that if the conditions are adequately standardised, the entire quantity of surplus molasses in the country can be successfully utilised as fertiliser.

Application of molasses to fields is not, however, so simple as it appears. In the first place it has to be carted in water-tight barrels and opened out with a tap. (The application must be carefully regulated as excessive amounts may prove to be highly injurious to the crop). The molasses must then be turned over and water let in to facilitate the fermentation. The fermentation may last from 3 to 6 weeks (depending on the nature of the soil) during which period no planting should be done. In fact, any surviving vegetation will be entirely killed out by either fresh or actively fermenting molasses. After the fermentation has subsided, the crop is planted and more water let in, care being taken that undue loss by drainage is avoided.

There has been some controversy regarding the residual value of molasses, but general experience would suggest that it is very small if not entirely negligible. Some doubt has also been raised regarding the efficiency of the direct application of molasses to land. Indeed, the recent work of Mr. T. R. Bhaskaran in these laboratories, would show that a large part of the sugar is destroyed and that only a small quantity of nitrogen is fixed. If, on the other hand, molasses is rotted outside the field and in the absence of air, the residual product is about three times as efficient as the orginal molasses in fixing nitrogen. This line of work is worth following up.

As things stand, direct application of molasses to fields is essentially a method of disposal. The producer cannot reasonably expect any big cash return unless he can convert it into a solid product which will not readily absorb moisture and which can stand transport over long distances If, in addition to that, the product rots easily and fixes more nitrogen than the original molasses, then it will become a commercial article, comparable in value to any good class seed-cake. In this direction some promising results have already been obtained by some Indian workers and it is hoped that, before long, the present 'waste product' of the sugar industry will become an important addition to the fertiliser resources of the world.—(*Reprinted from the Hindu.*)

PLANT NUTRITION

E. H. Gurney, A. A. C. I.,

Agricultural Chemist.

Plants resemble animal life in that they require food for their growth, and the food should be provided not only in sufficient quantity, but also in a suitably balanced form. In reviewing plant nutrition, other factors besides plant food have to be taken into consideration. Suitable environment, which includes both soil and climatic conditions, is a most important factor in influencing the growth, successful or otherwise, of any particular plant species.

About fourteen elements are commonly present in plants, and from these elements, with the aid of sunlight, green plants have the power of building their very complex structure. Plants obtain certain of their food requirements from the soil, and the general assumption has been that most soils contain the various plant food materials, though some soils may be insufficiently supplied with nitrogen, lime, potash, and phosphoric acid. Later investigation, however, has made it plain that a deficiency in some of the chemical elements existing in the soil, may cause poor and diseased plant growth.

Plant food is present in the soil in two forms which are respectively available to plants or unavailable. As a result of experiment and research, methods have been discovered by which the amount of available, plant food in the soil may be improved or maintained. By cultivation different soil granules are exposed to the weathering action of the air which converts some unavailable into available plant food. The ploughing in of farmyard manure, green-manure crops and waste matter, all increase the humus content of the soil, the humas during decomposition yields acids which convert insoluble plant food into a soluble form, capable of being taken up in the soil moisture, and a considerable amount of plant food contained in the organic substance referred to is returned to the soil. Lime, when applied to the soil, besides neutralising soil acidity, is also capable of converting some insoluble soil plant food ingredients to an available form. These methods of soil treatment tend to an improvement of tilth, and good soil tilth is of great value in providing plants with the most suitable condition for obtaining nutriment. It permits of the free entrance of circulation throughout the soil of both air and water and also of easy penetration of plant roots through the soil.

These condition do not prevail in a hard, compact, poorly cultivated soil, in which plants are unable to make the best use of the available plant food.

In the past it has been considered that the majority of soils contain sufficient elements for plant requirements, with the exception of nitrogen, phosphorus, potassium, and calcium, and that the soil supply of these four elements may require in some cases supplementing by the addition of manures and fertilisers to produce successful crops.

Later investigations in connection with plant growth show that an insufficient supply of some of the less prevalent elements in the soil, or the failure of plants in assimilating such elements, is sometimes the cause of unsuccessful crops, or the cause of disease in plants.

A few remarks may be made regarding the plant nutrients—nitrogen, phosphoric acid, and potash. In connection with nitrogen it is considered that plants generally take up their nitrogen requirements in the form of nitrate. Nitrogen increases the growth of plant and foliage, and deepens the green colour of the leaves. It also increases the size of the leaves. The pale yellowish tinge that occurs sometimes in green foliage may be caused through an insufficient supply of nitrogen to the plant, though this yellow tinge may be caused by other deficiencies. Plant leaves in sunlight have the power of fixing the carbon dioxide of the air and converting it into sugar which, being soluble, is circulated to different parts of the plant in the plant sap. Excessive supplies of nitrogen will cause an excessive growth rendering the plant less resistant to disease.

The fertilisers used for supplying nitrogen are:—Nitrate of soda, which is very quick-acting (the nitrogen being in the form of nitrate); sulphate of ammonia, which also is quick-acting; and blood manure which is fairly quick-acting, as its nitrogen is soon converted into the nitrate form in the soil. The nitrogen in bone dust and meatworks fertiliser is slow acting, as decomposition of the bone in the soil has to take place before the nitrogen is in an available form for plants.

Phosphoric acid as a plant food ingredient influences the production of seed, stimulates root growth and generally hastens the maturity of crops. Superphosphate supplies phosphoric acid in a water soluble form and is therefore quick-acting. As bone dust has first to be decomposed

its phosphate acid does not become available so readily to plants. Nauru phosphate is also a slow-acting fertiliser, and the effects from its application are more noticeable in the year after application.

In regard to potash, this plant food ingredient influences the production of carbohydrates, and the pulp of fruit and woody structure of plants. Potash is essential for the leaves of plant as it is required in the leaf process, mentioned before, of the conversion of carbonic acid into a carbohydrate, and also for the translocation of this carbohydrate throughout the plant. The potash fertilisers commonly used are sulphate and muriate of potash, both of which are quick-acting fertilisers. Wood ashes also contain various amounts of potash, but coal ashes contain practically none.

The necessity for having a balanced supply of the food ingredients mentioned, may be explained, as follows:—A large supply of nitrogen causes excessive and a very succulent foliage growth with low disease resistance. Potash influences the production of carbohydrates and woody substances, and for that reason potash will counteract the effect of too much nitrogen. Potatoes may be mentioned as a crop which noticeably shows ill results through an application of unbalanced fertilisers; for, if a fertiliser with high nitrogen content and somewhat low potash content is supplied to this crop, it will cause excessive leaf growth, but there will be insufficient potash throughout the leaves to influence the production of enough carbohydrates for the growth of satisfactory tubers. It will be seen then, that, with the application of a large amount of nitrogenous fertiliser, it will be advisable also to apply an ample amount of potash fertiliser.

Lime (containing the element calcium) though liable to be washed out of the surface to a considerable extent, is present in most soils in sufficient quantities to meet the actual food requirement of plants. Lime is applied to the land more for purpose of reducing soil acidity, and the obtaining of good soil tilth, than for plant food. In addition it must be mentioned that some crops such as lucerne and cabbage, require the presence of ample lime in the soil, whereas maize and sorghum will flourish on soils of a more acid nature.

Plant food material applied in fertilisers is rendered more available, if farmyard manure is applied at the same time as the fertilisers, even though the farmyard manure may be availabe in only a relatively small amount.

Investigations respecting the plant requirements of elements other than those previously mentioned have shown that a deficiency of some elements, even though they may only be required by plants in mere traces causes poor plant growth and plant disease.

Chlorosis, that is the abnormal yellowish colour of the plants' green leaf, may be caused through the deficiency of certain plant nutrients. Iron is necessary for the formation of the colouring matter (chlorophyll) of the leaf, and a deficiency of this element will cause chlorosis. There may be an abundance of iron in the soil, but if the soil has a high lime or managanese content, the assimilation of the iron by the plant will be prevented. This form of deficiency has been remedied in many cases by spraying with iron sulphate, or by applying the iron sulphate to the soil. It has been reported that in some cases, the spraying with iron sulphate and the application of iron sulphate to the soil, did not improve the condition of chlorotic apple trees; but that the injection of iron salts into the trunk of the tree was beneficial. The driving of iron nails into the trunks has also produced effective, though slower, results.

Copper is another element that may have considerable effect in maintaining healthy plant growth. In an investigation in connection with a type of chlorosis and "die-back" of fruit trees, it was found that the trouble was not remedied by the application of potash, iron, manganese, magnesium or sulphur; but that the application of copper sulphate to the soil surrounding the affected trees, at the rate of ¼ to 2 lbs. per tree, restored the trees to a normal condition.

That plants require for their most successful growth some of what may be termed the less abundant elements is recognised, and the element boron has been applied to some crops with favourable results. Zinc also has been reported as having been successful in controlling chlorosis of some plants.

The action in plant growth of these less abundant elements has been designated by such terms as "Catalytic" or "complementary"; but it has to be stated that the elements boron and zinc, in any slight excess have a very deleterious effect upon plants.

There are elements required by plants which in some soils may exist in ample quantities, whilst other soils may be supplied only poorly, with them. There are some plants, too, which require more than

others of a particular element; and in this connection, magnesium and manganese may be mentioned.

Magnesium is generally present in the soil in sufficient quantity for plant requirements; nevertheless, there are occasions when the application of magnesium salt have proved beneficial to crops. Thus magnesium is applied in some fertilisers for tobacco. In some citrus orchards in New South Wales chlorosis is considered as possible due to magnesium deficiency.

Manganese also is usually present in sufficient quantity in the soil; and, in some cases, in such quantity as to prevent the assimilation of iron by plants. But in some countries, experiments with the application of manganese salts has improved the quality of citrus fruits; and, in some of the epxeriments, has reduced chlorosis among the citrus trees. *(Ext. from Queensland Agri. Jour. of 1st July 1937.)*

INDIA'S IRRIGATED ACREAGE

Sukkur and Sutlej Project.

Irrigation,—without which a sixth of the crops would fail and hundreds of thousands of people would be reduced to starvation in India, is to be surveyed as a whole in order to calculate its numerous indirect benefits to this country, states a Note on.—"*Irrigation in India*".

Artificial irrigation is by no means one of the country's recent activities. She has practised it form time immemorial and is even said by some to be its orginal home. This, however, was irrigation of a primitive kind from tanks and wells. The Hindu and Mohommedan rulers improved matters to some extent, but the few dams and canals they built were of an elementary type. They are dwarfed into insignificance by those of the British regime in both magnitude and efficincy.

It is seldom realised abroad—it is even little known in India itself—that the acreage irrigated in India exceeds the combined total of that in the six countries which stand next to her in the list of the world's largest irrigation countries, including the United States. This acreage, traversed by some 79,000 miles of Government channel alone, has now reached the colossal figure of 40 millions and provides direct employment for no less than 50 million people, or a seventh of the countrys' population.

Another figure which conveys an idea of the immensity of irrigation operations in India is the quantity of water used for this purpose daily. It works out to the almost unbelievable total of about 260,000,000,000 gallons, equivalent to the flow of roughly 100 rivers of the size of the Thames in London during the winter.

A Vast Project.—It is not in irrigation area alone that India leads the way—her irrigation projects are among the largest in the world in many respects. Much has been heard recently of the vastness of the Sukkur Barrage system, one of the largest, if not the largest ever undertaken by man, which commands an area 1½ times that of Palestine. This, however, though justly famous, is only one of several schemes of almost equal magnitude to say nothing of hundreds of smaller ones—to be found in India.

In fact, there is at least one scheme, the Lower Chenab Canal in the Punjab, which on the basis of the figures for 1934-35 the latest available, actually irrigated nearly 2-1/3 million acres or about 440,000 acres more than the area actually irrigated by the Sukkur Barrage canals in the same period. There were six other schemes, each of which watered over million acres that year and several which closely approached that figure.

The Sutlej Valley Project alone, which is among the great schemes just mentioned, serves an area exceeding the total cultivable acreage in Egypt and the Sudan. The Sarda Canal in the United Provinces commands an area equal to that acreage.

In length of waterways, too, many Indian schemes rank high, even very high. Here the palm goes to the Lloyd Barrage system with its 6,500 miles of main canals, branches, distributaries and minors; but the Cauvery Delta system is only 2,100 miles shorter and four other systems total over 3,000 miles each. How many projects in other parts of the world can equal these ?

Astounding Figures.—In respect of dams, India is also well to the front. The Lloyd dam at Bhatgarh in the Bombay Presidency (which incidentally, has no connexion with the Lloyd Barrage system in Sind), contains 21½ million cubic feet of masonry, and in this respect surpasses the famons dam at Assuan in Egypt, which is so much talked about. Though some 2,000 feet shorter than the latter, the Lloyd dam is 70 feet higher than it. There is also the Wilson Dam at Bhandardara, another

work in the Bombay Presidency, which, though not quite a mile long, towers up for 270 feet and is one of the highest dams in the world. For length however, pride of place must be given to the Nizam-Sagar Dam in the Hyderabad State and for cubical content to the Mettur dam in Madras. The former is just under 16,000 feet long and the bulk of the latter is nearly 54,700,000 cubic feet. These again are astounding figures.

Several of the Indian works are characterized by originality of conception, boldness of design and excellence of execution. Prominent among them is the great Ganges Canal in the United Provinces with a total waterway of over 4,000 miles, a flow capacity of 8,000 cubic feet a second and a gross command of nearly 5½ million acres. It passes over and under a very large number of torrents, rivers and other channels and embodies the famous Solani aqueduct, one of the finest engineering feats of its kind in the world.

For its novelty, the Periyar dam in the Madras Presidency is worthy of mention. Built under great difficulty in a narrow gorge 3,000 feet up in the Western Ghats, it has diverted a river eastward from the Indian Ocean into the Bay of Bengal by means of a tunnel over a mile long, or about five times the length of London Bridge, bored through solid rock.

Equally remarkble are the headworks of the Cauvery Delta system, comprising four weirs of a total length of 2¼ milles and nearly 1½ miles of embankment.

As may readily be imagined, the cost of these gigantic works has not been light, notwithstanding the cheapness of Indian labour. The total capital outlay up to date is in the neighbourhood of Rs. 150 crores or roughly £. 100 million at the official rate of exchange. This money, however has been well spent, for the value of the crops raised with the assistance of irrigation is in the vicinity of Rs. 100 crores or £. 67 millon annually. The gross revenue amounts to about Rs. 13 crores or £. 3⅛ million and the net revenue therefore to Rs. 8 crores or £ 5⅛ million.

This represents a return of about 5½ per cent, which is a remarkable figure considering that a large proportion of the projects constitute what are known as "protection works" that is schemes designed to protect tracts against famine, not to yield profits.

Up to the present the financial requirement of new schemes has been that they shall pay 6 per cent. The Central Board of Irrigation, which

is a new body and typical of a new spirit among engineers, has launched a survey to estimate the gross value of irrigation schemes in the way of revenue from all sources, for such schemes spell not only an increase of and revenue and water rates but also enhancement in railway, postal and customs receipts to mention only the more obvious "subsidiaries". The object in view is to obtain more generous advances for new projects than is possible under the present restrictive practice.

The past and the present.—The benefits which irrigation has conferred on the country cannot be measured in terms of money or increase of cultivation alone, although these are the most tangible and readily computed. But some idea of the advance made during British administration may be gleaned from the following figures. Before the advent of British authority in India, when little had been done in the way of large irrigation works, the area under irrigated cultivation could not have exceeded a couple of million acres or so, though accurate information is not forthcoming. This has risen to 10½ million acres in 1878-79 and to 19¼ million acres by the beginning of the present century. Thirty years later it stood at 31.7 millions the highest reached so far. These figures exclude cultivation in Indian States and moreover relate only to areas irrigated by Government canals. There are large tracts irrigated by both Government and private tanks and wells, which cannot be overlooked and swell the totals further. In 1934-35 the area under well irrigation was approximately 12.6 million acres.

Many of the large schemes in the Punjab, notably the Triple Canals and the Sutlej Valley Projects, have resulted not only in increasing cultivation, but also in relieving the pressure on thickly populated regions by transforming desert, into cultural areas. This process is being extended and is yielding very satisfactory result from every point of view.

Hydro-Electric Power.—Looking to the future, irrigation engineers and Local goverments are taking up the question of developing electricity at irrigation works and of irrigating by means of tube-wells. In connexion with the former, much has already been done in Madras on the Cauvery Mettur System, while a comprehensive grid system is in operation in the United Provinces and another is in process of completion in the Punjab. Moreover, with an eye to the future, many of the schemes completed in recent years contain provision for the generation of hydro-electric power, should this be decided upon later. This development holds great possibilities.

Tube-well irrigation too has already been initiated in some provinces. It has found particular favour in the United Provinces, which contain the largest tracts of fertile land in the country and constitutes the centre of the growing prosperous sugar industry. In 1934-35, 255 wells were in operation and irrigated 31,831 acres. The figures for the following year had risen to 743 and 111,730 acres, respectively. Eight hundred and fourteen wells were working last summer and 1,500 are expected to be working next summer. Much is hoped for from this scheme.

Another proposal under consideration is the setting up of a Central Research Station under the ægis of the Central Board of Irrigation to deal with the many, varied, and urgent problems that confront irrigation experts. Here such matters as the meandering of rivers, seepage and water logging will be investigated and the results made available to all the provinces. There can be little doubt that such a Research Station will be of incalculable value not only to the irrigation engineer, but also to the cultivator and the exchequer of the country.—*Extract from Commercial Gazette of August 1937.*

CATTLE POPULATION OF INDIA

Alarming Rumours Refuted. (*Simla Aug. 12.*)

The following is a press note issued by the Education, Health and Lands Department through the Director of Public Information :—

What is the present position about the cattle population of India? There are some who think that the total number of bovine cattle in India is decreasing, and feel alarmed at what they consider to be a rapid decline in the livestock wealth of India. That this alarm is entirely groundless is proved by certain cattle statistics recently collected, which show that the number of cattle in British India actually increased from 146 millions in 1920 to 154 millions in 1930. According to the Livestock Statistics of 1935 for British India (excluding Bengal, Bihar and Orissa), the number of cattle in 1935 was 52 lakhs more than that in 1930 an increase of 4.9 per cent in five years. The situation is therefore, far from alarming. It may be noted, however, in this connection that the Royal Commission on Agriculture felt that what was needed was an improvement in the quality of cattle rather than an increase in their number.

Though the actual statistics completely demolish the case of those who argue that the number of cattle in India is decreasing, it is worth while to expose the fallacies in some of the arguments on which they rely in support of their contention. One of these arguments is that at the "lowest estimate", 35,000 cows are slaughtered every day for supplying beef to the Army. Another is that "one cow per minute" is being exported from India; in other words, that the total number of cows exported is 5,25,600 per annum. None of the arguments, however, stand scrutiny.

Decline in export of cattle.—Thus, the statistics show that even taking at a conservative estimate, 200 lbs. as the average dressed weight of an animal, the number slaughtered daily to feed the Army comes to only 249. The statement made in certain quarters that 35,000 cows are slaughtered daily to supply beef to the British soldiers means, in effect, that each soldier consumes three-quarters of a cow a day surely a fantastic estimate. Moreover, cows are not slaughtered for beef for the Army; the animals used are all oxen. The suggestion sometimes made that mutton may be supplied to the Army instead of beef once a week, is hardly worth considering, as the number of animals slaughtered forms but an infinitesimal part of the total, and the increased cost of such a change from beef to mutton is estimated by the Defence Department to be about Rs. 3 lakhs. As for the export of cattle from India, nothing shows up the exaggeration better than the Annual Statement of the Sea-borne Trade of British India, according to which the number of cattle exported has been steadily declining since 1927-28. The following are the figures of the cattle exported from British India:—

1927-28	18,354
1928-29	8,706
1929-30	2,226
1930-31	1,939
1931-32	756
1932-33	946
1933-34	779
1934-35	778
1935-36	407

It is difficult to imagine where the statement regarding the export of one cow a minute can have originated.

It is also sometimes suggested that the export trade in dry meat is

one of the causes of the decrease. Actually, however, the average annual export of dry meat between 1919-20 and 1928-29 is equivalent to only 81,771 animals, or .07 per cent of the total number of animals.

It is no doubt true that the number of cattle in British India per 100 of the population is only 61, while the number is higher in several other countries. But for purposes of comparison, it is much better not to take into account new and sparsely populated countries like Australia and New Zealand, where extensive pasture lands are available and cattle breeding is an industry in itself and conditions of comparison are not therefore the same. Compared to the old countries of the world, however, India appears to be better off than Germany, Italy, France and U. S. A.

The number of livestock of the bovine class (cattle proper) per 100 acres of sown area and per 100 of the population in each province is as follows:—

	Number of cattle.	
	Per 100 acres of sown area.	Per 100 of population.
Ajmer- Merwara	134	86
Assam	100	69
Bengal	108	52
Bihar and Orissa	88	57
Bombay	38	60
Burma	34	42
Central Provinces & Berar	56	89
Coorg	100	84
Delhi	75	24
Madras	75	53
North-West Frontier Prov.	50	44
Punjab	60	67
United Provinces	91	67

(*Hindu, August, 19, 1937*).

PUBLIC HEALTH DEPARTMENT

Central Provinces and Berar

Rabies.—Rabies is primarily a disease of the dog and the dog-tribe, such as the wolf, jackal and fox. Man, cattle, horses, bats, monkeys, etc.

also suffer from it following bites of rabid animals, which are commonly dogs and jackals.

A mad dog at first shows alteration in its behaviour, temper and appetite. Later on, it becomes furious and runs about biting everything which comes in its way. This stage of fury and excitement may be very short and unnoticed. Finally, the dog becomes paralyzed, the paralysis commencing in its hind legs and spreading to other parts. In this stage—Dump Rabies—the animal drags its hind legs and is unable to eat drink or bark. Profuse and frothy saliva usually drips from its mouth. This saliva contains the deadly germs of the disease and is injected into the body when the animal bites. It may enter the body through minute, almost imperceptible, abrasions or punctures in the skin of the face and hands, if these happen to be licked by a rabid dog.

The bite of a dog may be infectious up to fourteen days *before* it shows signs of madness, so that if a dog, which has bitten a person, remains healthy up to fourteen days after the event the bitten person is not liable to contract the disease and need not undergo anti-rabic treatment. It is, therefore, very important that when an apparently healthy dog bites a person it should, if possible, be kept chained up and placed under close observation, preferably by a veterinary doctor, for fourteen days.

Fortunately, the disease does not supervene till many weeks—three to thirty or more have elapsed since a bite from a rabid animal. This fact furnishes a favourable opportunity for the taking of treatment to ward off the evil. The earlier the treatment is adopted the greater the chances of success. The more extensive the bites and nearer the head, the more quickly the disease comes on. Bites on the face and neck are the most dangerous and call for immediate treatment. *Once a bitten person develops signs and symptoms of rabies, no treatment is of any avail and death is practically certain.* It is also one of the most dreadful and distressing forms of death.

There are two important steps to be taken, *viz* :—

(1) On being bitten by any animal, whether it appears healthy or mad, proceed *immediately* to the nearest hospital, dispensary, or doctor to have the wound cauterised. The best chemical for this purpose is NITRIC ACID. Strong disinfectants, such as carbolic acid are not reliable. *Thorough* cauterisation with Nitric Acid—*special care*

being paid to the edges of the roken skin—if carried out within a few hours after the bite, will greatly reduce the risks of contracting the disease.

(2) The recourse to the special injection treatment should be invariably had under the following circumstances :—

(*a*) When the animal is obviously mad—*Immediate treatment.*

(*b*) When there is any suspicion about its being so. In this case, treatment should be started immediately but should be discontinued, if further observation fails to establish the diagnosis.

(*c*) If the animal is not mad at time of biting, but becomes so within fourteen days subsequently. This indicates the importance of not killing the animal (unless it is obviously mad) but keeping it under observation. If this is done, a great deal of anxiety and uncertainty will be obviated and it will also save one from undergoing unnecessary treatment, if the animal remains healthy up to fourteen days following the bite.

(*d*) When the animal (dog or jackal) runs away and cannot be traced or identified—*Immediate treatment.*

(*e*) When the animal is killed on the spot and it is not certain whether it was mad or not—*Immediate treatment.*

(*f*) When a person has been licked on the hands or face by an animal which becomes rabid within fourteen days afterwards.

Note.—**In case of doubt always take the treatment.**

Arrangements for the carrying out of treatment should be made in consultation with medical officers in charge of hospitals and dispensaries. As procrastination or delay may cost one's life, no time should be lost in getting into touch with these officers.

It will be the height of folly to place reliance on any treatment other than immediate cauterisation and special injections. These measures have been tested and tried and adopted all over the world as they have been found efficacious.

Prevention of Rabies.—The pi-dog is the commonest source of the disease for human beings, for privately owned dogs and for other animals. It should, therefore, be systematically and completely destroyed. It is not cruel to do this. A rabid dog itself suffers untold and prolonged torture and pain and is capable of greatly multiplying these by inflicting the same disease on man and other dogs and animals. It is far more merciful to quickly destroy these pi-dogs. Apart from the risks of rabies the lot of the average pi-dog is miserable. Starvation, ill-treatment, infestation with vermin and constant irritation, eating of a foul food (including carrion), mange and unsightly skin diseases, etc., are common portions of such animals.

Licensing of privately owned dogs and their muzzling during prevalence of rabies are important preventive measures, but they are useless as long as pariah dogs are allowed to remain.

CINCTURING FRUIT TREES

The operation of cincturing fruit trees is very much older than the name by which it is designated. In the early part of the 18th century, monks hastened the fruiting of young pear trees by cutting away a piece of bark near the root of the tree. In the middle of the same century, gardeners in England brought young, rampant fruit trees into bearing by cutting a strip of bark from ½ inch to 1 inch wide (according to the size of the tree) nearly around the trunk at a convenient distance from the ground, leaving a portion of the bark on both sides of the tree as a bridge for the descending sap.

The Principle Involved.—Roots take from the soil moisture, small quantities of minerals. The total intake of water is large, but the amount of minerals simultaneously absorbed is not great; anyone may demonstrate this by burning a vine until nothing but white ashes remains. Of the total bulk of the vine, the white ash represents the minerals absorbed with water from the soil.

The water with—the mineral food held in solution—travels up the stem of the vine through the tubes of sapwood. There are many of these tubes, and a large quantity of water passes continuously up them. Any one who has cut off a vine in spring and noted how it "bleeds" appreciates this upward movement of water and minerals. This sap consists largely of water with small quantities of plant food in solution. The loss of plant

food is not great, which explains why the "bleeding" of a vine pruned late has no marked weakening influence on the vine. The water with its dissolved mineral passes up the stem of the vine along the arms, and ultimately to the leaves. Here, excess water is evaporated from the leaf surface. Whilst the leaves take in carbon dioxide from the air, and in the presence of sunlight, the green matter of the leaf assimilates carbon. The carbon so absorbed from the air is united with water and solutes from the roots, and elaborated sap is formed to provide for the growth of the plant.

The next process is the distribution of sap to all parts of the plant. No growth can take place without this sap. The elaborated sap is carried to every part of the vine in the layer between bark and wood. In spring, the new shots grow in length from the growing point, the material for growth being derived from the leaves, and in the early part of the season, from food materials stored in the vine over winter. The roots grow and can only grow by using the elaborated sap sent down to them from the foliage. That is to say, root growth is ultimately dependent on material supplied by the foliage. It will be readily understood that when a ring of bark is taken out around the stem of the vine, it does not interfere materially with the upward flow of water from the roots. However, it does check the downward flow of sap to the roots. The result is that elaborated food material is available for the development of growth and fruit, but not for the extension of the root system. The roots obtain fresh food materials by constantly sending out new rootlets and root hairs in fresh soil, and if the supply of sap is permanently cut off, they cannot do this, and the plant eventually starves. If, however, a slight girdle is made which will heal over in few weeks, and reestablish channels for downward movements of sap, no permanent harm results. Healing can be accelerated by the placing narrow strips of waxed cloth over the cinctures.—(*Extract from Journal Of Agri of South Australia of July 1937.*)

A NOTE ON THE CULTIVATION OF PARWAL CROP IN THE NORTHERN DISTRICTS OF C. P.

MANIRAM SINGH BARKER.

Parwal.—Natural Order-Cucurbitacæ.

Botanical Name.—Tricosanthes, Diocia.

It is always grown as a catch crop in Pan gardens. The plant is a perennial creeper which attains a height of about 12 feet.

Variety.—Only one variety is grown. The fruits are more or less oval shaped, green in colour with ten whitish longitudinal lines. The size of the fruit is just like that of an ordinary egg.

Soil.—It does well on well drained alluvial light soils, such as Pirotha, Sehra Domatta etc. required for Pan gardens.

Cultivation.—The land is well pulverized as is done for Pan gardens.

Time of planting.—The creepers are planted from February to March just at the time, when the Pan vines are planted.

Method of planting.—The old creepers are cut into pieces of about one foot and formed into coils, which are placed in the soil in the rows of Pan vines at 5' to 8' feet apart, keeping the ends above the surface with a few nodes in them. The coils are gently pressed till they get firm in the soil.

Period of growth.—Germination of eyes near the nodes takes place and the creepers trail on the "Gedis", or wooden posts fixed in the ground in the Mandavs of Pan Gardens. The crop takes 4 to 5 months for its growth and begins to bear fruits from the middle of July. The fruiting continues till the end of October. The heaviest bearing is during August and September.

Irrigation.—The crop is watered twice or thrice a day along with the Pan vines in hot weather. Irrigation is done by hand by means of earthern pots known as Lutias. The number of waterings are the same as are for Pan vines.

Manuring.—The crop receives the same manure i. e. cake as is given for Pan vines.

Earthing.—The crop is earthed up twice a year i. e. in June and September. The object of earthing is to cover the exposed roots of Pan vines and Parwal. The two feet space between the two Pan vine rows is earthed up by putting 3" to 4" earth (silt) from out-side. The earthing is done by hand labour as the earth is brought on heads of coolies in baskets and slowly put in between the two rows. This work is mostly on contract.

Yield.—About 3,000 creepers are planted per acre, each creeper bears on an average 50 fruits. Thus the total number of fruits per acre is about 150,000. About 60 to 70 fruits weigh a seer and one seer parwal is sold for -/3/- to -/4/-. It is also sold at the rate of -/4/- to -/6/- annas per hundred fruits. Thus the total value realised per acre comes to about Rs. 450/-

As it is a catch crop it is not possible to give details of expenditure. Calculating the number of plants in Pan vines per acre the total number of Parwal plants comes to about 1/7 of the Pan vines.

The Parwal creeper trails straight on the wooden posts and spread over the Mandwa, which is 8 feet high from the ground. If the creeper spreads thickly *more* on the Mandwa heat is produced inside the Pan gardens. Hence pruning has to be done occasionally to check the growth of the Parwal vines.

The Parwal vine helps to some extent to keep up shade inside the Pan gardens by which fast evaporation is checked and the number of irrigations is reduced.

Parwal is liked for vegetables, and mostly well to do persons can afford to use it. It is considered to be a healthy vegetable and can be kept for 3 or 4 days safely after plucking.

Green fruits are liked for vegetables and not ripe yellow ones.

SUGGESTIONS FOR ARRANGING AND PROLONGING LIVES OF CUT FLOWERS

Mrs. Ware, Wepowie

No home has achieved its best until flowers have their rightful place in it. Flowers can add the final lovely accent to the colour scheme. Some people have an instinctive flair for producing interesting and charming floral arrangements. However, given a natural love for flowers any one can soon learn how to obtain satisfying results if a few simple rules are learned; speed comes with practice.

True lovers of flowers are for ever experimenting with colour and trying new ways of grouping, and more often than not the results are enchanting. For instance, a large meat dish can be used for skilfully arranging short-stemmed simple garden blooms. Some examples of flowers which look well arranged thus are Petunias, Phlox, Begonias, Forget-me-nots, Autumn Leaves with Fuchsias, Violets on their leaves or Nasturtiums with their bright circular leaves. A judicious combination of flowers makes for interest and avoids monotony, but, in all cases, a single kind of flower should predominate.

The scope of arrangement is endless, the effect always charming, if taste is used in choosing suitable flowers for each arrangement. For instance,pieces of shrubs with green leaves and coloured berries or pods placed in wet sand in an oblong box make a bright suggestion for a day time screen for the fireplace, whereas Dalias would be out of place. Then, again, imagine deep, rich-red Cactus Dahlias as a central decoration on a formal dinner table-their dignified beauty accentuated with shining silver and glass on a polished mahogany table, and tall, tapering red candles in flat silver holders shedding a soft light over the scene. Marigolds, Nasturtiums, Gailllardias, and the like would be out of place here, and yet they would be happily at home on the breakfast table.

To Prolong Lives of Flowers.—Flowers should be cut during the coolest hours of the day, when the tissue is filled with moisture-early morning or late afternoon. They should be cut with a sharp knife. If the cut is slanting, the water-absorbing surface is increased considerably, particularly when the stems are thick and heavy. Another advantage is that a slanting cut prevents the cut surface from resting squarely on the bottom of the vase or bowl and clogging the tubes through which the water is drawn into the stem. In any case, the stem should never rest on the bottom of the receptacle.

Do not arrange flowers immediately upon gathering them; they are likely to wither quickly. Rather, after cutting plunge the stems in a deep receptacle, water filled, but do not submerge the blooms, and leave in a cool place for a few hours. Flowers which have been thus "cooled" are more easily and quickly arranged, for the stiffened stems permit the placing of each flower in the definite position it is to occupy in the floral scheme. The lower leaves should be removed, for not only do they choke up the vase and make arrangement more difficult, but also they become slimy and unpleasant in a very short time. Flowers that have wilted after a journey may be freshened by plunging the stems into boiling water and leaving them until the water is cool. Then cut off the ends of the stalks and put into cold water to properly revive. It is also claimed that a small piece of charcoal in the bottom of the vase will prolong the keeping qualities of flowers. Another idea is to stir a teaspoon of saltpetre or of carbonate of soda into the water in which the flowers stand each time the water is changed. Abemones and Ranunculi last much longer if placed in a bowl of wet sand.

College and Hostel News

As in the past years the first term was marked by the celebration of socio-religious functions.

The first celebration was the birth of Lord Krishna known as Janmashtami when we had the privilege of having The Hon'ble Mr. Mehta, the Finance Minister amidst us. After the prayer song with which the function began, the Minister addressed us for about half an hour. He specially pointed out the importance of discipline in life. We thank the popular Ministry for so very readily accepting our humble invitation and pouring in words of advice and encouragement.

Several competitions of academic nature were also arranged; Mr. R. K. Shukla won the first prize in essay writing and our congratulations go to him for that.

"*Rani Durgawati*" a Hindi drama was enacted with great success. Mr. N. B. Gupta the drama Secretary appeared in the role of the heroine and played his part very successfully. For his excellent acting he was awarded several prizes by the students and the staff of the College. Messrs. Kachhawaha as *Sumati* and Abdul Wali as *Akbar* were also highly appreciated by the audience.

We thank Messrs. R. N. Kayasth, R. N. Misra and S. K. Misra who very kindly coached the students in the rehearsals.

Ganesh Festival was celebrated with great eclat. On this occasion we had the Hon'ble Pandit D. P. Misra amongst us, who very kindly made a speech full of sound advice. He explained the significance of such festivals and remarked that in their observances provincialism should not exist at the cost of nationalism.

During the Ganpathi Festival celebrations the chief item of the programme was the enacting of the Marathi play "*Lagnachi Bedi*" under the presidentship of Professor B. R. Phatak. Messrs T. G. Deshpande and Purohit received a number of prizes for their histrionic talents.

The comic parts played by Messrs G. R. Tatwawadi and G. P. Deshpande made the audience burst with laughter. The sweet music by Messrs. S. N. Joshi and Deshmukh was an additional charm to their even otherwise and excellent acting.

We are highly obliged to Professor B. R. Phatak and Mr. N. G. Joshi for their able direction in the drama.

Our heartfelt thanks are also due to Messrs B. S. Rao, Athawale, R. H. Joshi, and G. H. Joshi for ably supervising the musical side of the drama.

Other programmes included the delightful entertainment in classical music by Mr. Morghade from Gwalior, physical feats by Mr. Jadhao and Mela and Musical Variety Treat by Shree Ram Sangit Vidyalaya under the able guidance of Professor S. R. Sapre.

In our fight for the superiority in games in the Inter-University Tournaments we were less fortunate. Our lot was cast with the College of Science. The Football Match was played ending in a draw on the first day but unfortunately we were defeated in the replay after a gallant fight.

In cricket and hockey we did our best but had to yield in the end. This year our Volley Ball Team entered in the "C. P. and Berar Stent Volley Ball Cup" tournament held here. We defeated the Hislop College in the second round. However we lost against the Muslim Team from Bhandara after a keen fight. It was the first time that our College

entered a Volley Ball Tournament and we hope to make a better show next time.

U. T. C.—A large number of students joined the Corps this year and showed great enthusiasm in taking military education. This year our College has our own Under Officer in Mr. T. G. Deshpande. Though the platoon consisted only of the recruits yet they were able to retain the "G urd Mounting Cup" won last year. Another cup known as "Best Recruit Shot Cup" was won by Mr. D. R. Yadao.

The following promotions were made this year.

Mr. I. S. Dube,--Under Officer.
Mr. N. B. Gupta,—Sergeant.
Mr. D. R. Yadao,—Corporal.
Mr. S. S. Khokle,—Lance Corporal.
Mr. P. C. Verma,— „

The College and the Hostel were visited by the Hon'ble Pandit Ravi Shanker Shukla, Education Minister during the middle of November. We are glad to learn that the Nagpur Municipal Committee has decided to remove the Pail Depot which is situated near our hostel. We heartily thank them for their decision and hope that they will be quick in the execution of their decision.

Departmental Notifications

TRANSFERS

Name of Officer.	From	To
Mr. N. K. Nerikar.	A. A. Mehkar	F. S. Buldana.
„ G. B. Deshmukh	F. S. Buldana	A. A. Mehkar.
„ M. B. Malwatkar	A. A. Wun	A. A. Chikhli.
„ W. A. Chaudhari	A. A. Chikhli	A. A. Wun.
„ S. G. P. Tiwari	F. O. Yeotmal	F. O. Ellichpur.
„ R. P. Verma	F. O. Ellichpur.	F. O. Yeotmal.
„ J. S. Gurjar	Leave	E. A. D. Jubbulpore.
„ N. R. Ramayya	Offg. E. A. D. Jubbulpore	A. A. Jubbulpore.
„ L. N. Dubey	Leave	E. A. D. Chindwara.
„ A. H. Barde	Leave	A. A. Daryapur.
„ V. R. Deshpande	Leave	A. A. Chandur.
„ J. N. Kelkar	Tempy. A. A. Malegaon	A. A. Khamgaon.
„ M. V. Jamkhandikar	A. A. Basim	Charge of Malegaon circle in addition to his own duties.
„ G. T. Joshi	A. A. Khamgaon	A. A. Mehkar.
„ G. M. Joshi	Leave	Rejoin at Ellichpur.
„ T. N. Puranik	Tempy. A. A. Daryapur	A. A. Malegaon.
„ S. G. Mutkekar	Leave	D. D. A. Western Circle.
„ P. D. Nair	Offg. D. D. A. Western Circle	Offg. D. D. A. Northern Circle.
„ J. S. Gurjar.	E. A. D. Jubbulpore	Foreign service under I. C. C. C. Marketing Officer (verum cotton marketing operation).
Mr. N. R. Ramayya	A. A. Jubbulpore	Offg. E. A. D. Jubbulpore.
Dr. R. J. Kalamkar	A. D. A, Nagpur	Offg. D. D. A. Northern Circle.
Mr. P. D. Nair	Offg. D. D. A. Northern Circle	Offg. D. D. A. Economics and Marketing.

Leave.

Mr. G. B. Deshmukh	A. A. Mehkar	L. A. P. for 4 months from date of relief.
„ R. P. Verma	F. O. Yeotmal	L. A. P. for 1 month from 18-10-37.
„ Govind Prasad.	Offg. D. D. A. Northern Circle	L. A. P. for 4 months from 8-11-37.

OBITUARY

It is with deep regret that we have to announce the death of Mr. G. D. Mehta, Offg., Deputy Director of Agriculture (Economics and marketing), on the 3rd December at Nagpur.

He had endeared himself to one and all in the Department and it was a shock to us to hear of his untimely and premature demise. We offer our sincere condolence to his relatives in their bereavement.

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Editorial Notes

We feel happy to inform our readers that J. C. Mc Dougall Esqr., M.A., B.Sc., has, after sojourning and recouping his health in the United Kingdom, returned and assumed duties as Director of Agriculture, Central Provinces and Berar.

We heartily congratulate Dr. V. G. Vaidya, B.Ag., Ph.D., one of our past students, on his having been conferred the degree of Doctor of Philosophy by the Bristol University for his thesis on "The Seasonal cycles of mineral elements in the terminal shoots of apple trees and the effects of five vegetatively propagated root stocks on these." Dr. Vaidya took his B.Ag. degree of the Nagpur-University in 1935 topping the list of successful students in the first division. Dr. Vaidya, has, we understand, specialised in several branches of Horticulture, and Fruit preservation. We are glad to learn that he has been awarded the fellowship of Bristol University and has been retained by the Horticultural Research Station, Longashton, Bristol, to carry on research on nutrition of plants. We wish him a prosperous future.

RELIEF OF AGRICULTURAL INDEBTEDNESS IN MADRAS

It has been said—and rightly so—about the Indian farmer, that he is born in debt, lives in debt, and dies in debt, passing

the burden of his debt to his survivors. The result of this is that he has learnt to understand this state of indebtedness

Table Showing the average harvest prices of Cotton (Ginned) and Average outturn of Cotton in the Central Provinces and Berar for the period 1921-1936.

	1921-22	1922-23	1923-24	1924-25	1925-26	1926-27	1927-28	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35	1935-36
Average prices per maund in Rupees...	31	43	58/8	43	34/4	26	32	28/12	20/8	14/8	18/10	14	16	21/2	16/12
Average outturn in anna notation ...	14	11	11	11	9	9	12	12.5	11.6	11.6	5.5	9.2	8.7	7.4	8.2

as a settled fact in his life, like a patient who becomes used

to a chronic ailment. Yet, the occassional spells of good days have somehow maintained the equilibrium between his normal expenses of cultivation and the yearly returns. But ever since the recent trade depression set in, along with other industries, the agricultural interests have been hit very hard. The prices came down to their lowest level, making agriculture most unremunerative. Combined with this, there came a series of bad years which simply resulted in aggravating the situation. These two causes have landed the agriculturists in an impossible situation. Inspite of this, the people are yet found to stick up to their lands, mainly because agriculture occupies such an indispensible place in our national economy, that to the major population of the country, it forms more as a mode of living, than as a profession. They have no alternative means of livelihood to choose between.

The following table will substantiate the statement by showing how in the C. P. and Berar, the average price of cotton has fallen, and the average outturn has also simultaneously fallen.

Under these circumstances the obligations that the agriculturists have incurred, when times were much better, and the future slump was not foreseen, have still to be met with great difficulty. Encouraged by the high prices, which yielded enormous profits to the agriculturists, many of them ambitiously bought new lands by paying extra-ordinarily heavy prices, with the hope of making good their investments in no time. Over and above this, many of them borrowed money for various unproductive purposes as well. No wonder, this action bears eloquent testimony to the truism that "debt follows credit". This money was borrowed at a high rate of interest which then prevailed due to the general rise in the demand for money in the money market of India.

But, with the coming down of the prices, to such a low level, all their hopes proved to be dupes, and the existing relations between the debtor class and the creditor class have been violently disturbed. With the fall in prices which we may approximately estimate to the extent of nearly fifty per cent the purchasing power of money has been nearly doubled up. To pay now, an equal sum that was borrowed in the pre-depression days, or a rate of interest fixed up then involves double the sacrifice than was agreed to. The same thing becomes more clear to us when we view it in terms of commodities. To pay now the same sum that was borrowed then, would buy double the commodities now, if the fall in the prices be taken as fifty per cent. The debtor therefore pays more, if represented in terms of commodities to the creditor, though in terms of money he does not pay a single pie, over and above the money borrowed. To put into a nut shell, the changed circumstances have resulted in benefitting the creditors at the cost of debtors.

The post depression days depict a woeful tale of the distress of the landed interests. Many of them had to sell away their lands to meet the ever accumulating tide of interest charges. Those who avoided such a voluntary resignation have been forced to be dispossessed of their lands with the help of the civil courts. The Co-operative Societies that have financed the agriculturists in many parts of the country repeat with one voice the same cry of the accumulated overdues. The fact is that it is impossible for all the cultivators to meet all their liabilities. This has been purely an outcome of the working of the economic forces in an unfavourable direction. No fault can therefore be laid at the doors of the cultivators for precipitating such an impasse.

However, desperate situations call for desperate remedies. To follow a bold policy of revising the obligations of the various agriculturist-debtors, and to bring them in line with the order of

the day, is the bounden duty of the State. It can in no way be objected to, by the creditors as they do not stand to lose anything, in any way. Though the sum payable today is scaled down, yet due to the fall in the prices, which has resulted in increasing the purchasing power of money, it would represent nothing less than the sacrifice that was made by the creditor in advancing at a time when the prices were high and the purchasing power of money was lower. In case of those moneylenders who have, inspite of the changed circumstances, already received by way of interest a sum equal to the principal advanced, will have little support in fighting for the continuance of the interest charges. As has been pointed out recently by a committee which enquired into the problem of indebtedness in Travancore, in many cases, the agricultural debt, as is outstanding today, is largely the burden of the accumulated arrears of interests. To sum up, the financial obligations of the present day agriculturist-debtors have to be revised, with the help of new legislation. This legislation will simply aim at striking a balance between the debt advanced and the debt payable. It would therefore mean no intentions of benefitting one class of the public at the cost of another. In fact, such an action will meet the ever desired ends of justice, equity, and good conscience.

The various provincial governments which have recently come into power have rightly made, rural development as the nucleus of their programme. Amongst the many vexed problems in this field, relief of agricultural indebtedness needs the earliest attention. Accordingly, we find the Madras Government have prepared a bill for the said purpose. We state below the important provisions of this bill which is contemplated to be called as " The Madras Agriculturists Relief Act 1938 ".

I. The Act will be applicable to all the agriculturists in the Province of Madras. An agriculturist would mean one who has any saleable interest in any agricultural or horticultural land, or one who holds a lease of such a land, provided that (a) he is not

assessed to income-tax for any of the last two financial years. (b) or is not assessed to a professional tax during the same period on a half-yearly income not exceeding Rs. 300, which is derived from any non-agricultural source. (c) or is not the owner of a property situated within the jurisdiction of any local body, and consisting of houses, buildings or non-agricultural lands whose income is above Rs. 600 per year.

II. The term debt means any liability in cash or kind whether secured or unsecured, but does not include rent.

III. Debts incurred before 1st October 1932 shall be scaled down in the following manner :—

(a) All interest outstanding on the 1st October 1937 shall be deemed to be discharged, and only the unpaid principal shall remain outstanding.

(b) Where an agriculturist has paid to any creditor twice the amount of the principal whether by way of principal or interest or both, such debt including the principal shall be deemed to be discharged. But where the sum repaid falls short of twice the amount of the principal, such amount only as would make up the shortage, or the principal or any portion of it which has remained unpaid, whichever is smaller, shall be deemed to be payable.

(c) The above provisions will be applicable only to those agriculturists who had acquired interest in their agricultural lands prior to 1st October 1937.

IV. Debts incurred on or after 1st October 1932 shall be, scaled down in the following manner :—

On all the sums that are outstanding at the commencement of this Act, interest will be payable only to the extent of five per

cent per annum (unless the agreed rate or decreed rate be less) provided that :—

(a) facility shall be given to those debtors who have already paid something, by arranging the present liabilities in such a manner, that the interest charges will be calculated only at the above mentioned rate, and any excess that has been found to be paid over and above the calculated sum of interest shall be deemed to be credited to the principal.

(b) any debt which is renewed shall be deemed to be a debt contracted on the debt when the prior debt was incurred and shall therefore be within the purview of any of the above provisions according to the time prescribed.

(c) In respect of any sum that has already been paid by the debtor no refund will be made by recalculating the debts, according to the provisions of this Act.

V. No debt incurred after the commencement of this Act shall bear interest at a rate higher than 6¼ per cent per annum simple interest.

VI. The following are the provisions regarding the arrears of rent.

All rents payable by an agriculturist which have accrued for the fasli year 1345 or prior faslis, and which are outstanding at the commencement of this Act, are deemed to be discharged, provided that where a ryot does not pay all arrears of rent accruing on the faslis 1346 and 1347, on or before 30th September 1939 will not be able to take the benefit of the above provision. Those who pay only a part sum, will be discharging only a like proportion of the rents outstanding prior to the fasli year 1345.

So also the above privilege cannot be enjoyed by those who have not paid their rent dues for the fasli 1347, on or before 30th September 1938.

Original Articles

HINTS ON POULTRY FARMING AS A SECOND STRING TO THE FARMERS BOW

B. L. CHOUDHRI.

There is undoubtedly the wide spread opinion that the average Indian cultivator does not get enough from agriculture to maintain himself and his family in comfort. The C. P. Banking Enquiry Committee expressed the opinion that the average culcivator obtains less to eat than the prisoner in the jail. Referiing to this low productivity from the land, Sir M. Visvesvarayya writes "On the normal pre-war basis, the average production of British India including irrigated crops cannot be more than Rs. 25/- per acre". Over and above this the vast increase in population is pressing too hard on the meagre supplies that the head of the family can provide. In short, we can say that 'only the cultivator who is having two strings to his bow can keep his head up'. In other words, Indian agriculture must be supplemented with a spare time industry. Taking into consideration the economic position of an average farmer and his inability to invest a large capital, poultry farming can be best recommended as a secondary industry for him to take up. Besides yielding a good net profit, the manure got is very valuable. Poultry helps him in checking some of the farm enemies like insect pests etc.

Selection of breeds.—There are many breeds of fowls. Some are beautiful ornamental birds well suited for those who keep poultry only for fancy-sake. With these people utility is not the question. Some are both beautiful and profitable too and can be kept economically with the least amount of care, while there are others, which are very delicate, and others again which not only thrive well but also multiply rapidly.

The selection of breed will depend upon the object and the environment including the climatic conditions of the locality. Our object is, when the business is a subsidiary one, to get as much net income as possible with the least amount of expenditure and care in management. Under most of the Indian conditions White Leg-horn can suitably be recommended for the farmer. The laying capacity of this breed is quite high. The average result on the Telenkhedi Farm, Nagpur, is 250 eggs per annum. It gives fairly large white eggs.

Housing.—The construction of a proper type of house is most essential to make an undertaking successful. The principle underlying the erection of a house is that it should be roomy, well ventilated and insect and waterproof. The nature of the house depends upon the climatic condition of the place.

The fundamental principle in a poultry house is that it should be very well ventilated, because birds require more fresh air than any other animal.

The method to be adopted for housing differs according to the climate and also the nature of the concern. There are very many types of houses recommended by experts but under the Indian village conditions an ordinary bamboo house is quite good. The bamboos used for this purpose must be coal-tarred.

The birds must be protected from the effect of the seasonal factors. In the rainy season protection may be easily achieved by using 'Zaddapi' (bamboo screens). Such screens or some old gunny bags should be hung on the wind-ward side leaving a clear space on the side wherefrom the birds get the sun's rays in the cold season.

In those places where temperature goes very high, the summer becomes the worst season for poultry. The birds are found to do better when kept under the following conditions. Dig a pit sloping inwards upto a depth of 2 ft to 3 ft. Put a bamboo *jaffri* over it allowing a passage for the birds to enter. Some loose earth is also put over the jaffri to maintain a cool atmosphere in the pit. Water for drinking purposes must be kept inside this. The birds in the noon, when it is very hot, will go in the pit and rest there.

The most important thing in following this method is to give the best possible attention towards the daily cleaning and frequent disinfection of the pit.

The interior of the house should consist only of nest boxes and perchers. These should be moveable.

Provide each house with two runs which may be used in rotation with some poultry food crops like sun flower.

It is always economic to construct a square house.

Shade and Shelter.—It is very necessary in India to protect the poultry from tropical sun's rays. It is always better to take advantage of the natural shade. Some small fruit plants may be grown in the poultry run with advantage mutually.

A shade open in front, should be provided for sitting hens.

Scratching.—The best form of exercise that can be given to the poultry is to give grains to them in litter, so that the birds may be required to search for their food.

Dust-Bath.—It is very essential to provide dust-bath for the fowls. The best material that can be used for this purpose is the road-dust, cow-dung ashes and fine sand mixed with some disinfectants like sulphur or dry tobacco-dust.

Feed & water.—Cleanliness of feed and water is the greatest asset to the poultry business. Ample and ready supply of clean water must be maintained.

Green food in all the cases should be an important item of the ration. The supply of minerals and vitamins must also be properly maintained.

Regularity in feeding and all other treatments must be assured.

Eggs and hatching.—Laying of eggs generally begins in February and is continued upto July with a few intermissions. The moulting usually begins in July. The best prices for eggs are everywhere got during the cold season. Our attempts hence should be to produce the commodity when the demand is at its maximum. This can easily be achieved by a proper balanced and regulated ration.

For the first time the pullets lay eggs when they are 5 to 6 months old. The best time to raise chickens is from November to March. The chicks raised at this time become quite grown up upto the beginning of the monsoon hence they acquire some resistant power against its effects.

Selection of eggs for hatching.—The following points should be observed in selecting the eggs for hatching:—

(1) Select eggs only from the best birds.

(2) Use only the fresh eggs.

(3) Reject very small and very big eggs.

(4) Eggs meant for hatching should *not* be exposed to sun's rays.

Selection of the sitting hens.—The next thing that requires a careful selection is the mother or the sitting hen. The following are some of the points that should be taken into account while selecting the mother:

(1) The mother should be healthy.

(2) She should be thoroughly broody. She must be tested for this by keeping some false eggs under her before the desired eggs are entrusted to her.

When to start sitting.—The best time to make a hen sit is at night when there are more chances of her sitting.

The sitting hen with the eggs must be kept aloof from the other birds. A quiet detached corner is best suited. An ordinary *Deodar* box or *Ghamala* (flower pot) is excellent for this purpose. Put 5 inches of fine dry cow-dung ashes in the box. Make an oval depression in the middle and then put soft broken hay or *pival* over this. Arrange the eggs on this and then allow the hen to sit.

It is always better to have a separate room for the sitting hen. She must not be kept in a damp dirty draughty or badly ventilated place.

Under ordinary conditions 9 to 12 eggs can be kept under each hen depending on her size.

The chicks take 21 days to hatch. On the 20th day their sound inside the eggs can be heard.

Treatment to the mother and the eggs.—Test the mother for her being thoroughly broody.

Powder her under wings with some insecticidal powder e. g. sulphur.

Every day in the morning and in the evening the hen must be allowed to leave the eggs and take exercise for half an hour.

She must be given feed and water twice daily. Give the food when she comes off the nest and never when in the box.

If proper care is taken a hen should raise 75% of the eggs.

If there is any breakage remove the broken eggs and wash the other eggs if they are soiled. The water used for the hen must have its temperature at 102° F.

When the weather is very hot and dry warm water may be sprinkled over the eggs.

On the 21st day if there are some unhatched sound eggs (the embryos of which are not dead) keep them under another hen.

MANAGEMENT IN GENERAL

Chickens.—When all the chicks have hatched out remove the hen with the chicks from the box to a suitable place. Allow the chicks to remain under her wings and take care to protect them from getting chilled.

For about 24 to 36 hours chicken should not be given anything to eat. Feed the mother and the chicks separately.

After 36 hours or so the chicks may be fed on the ration shown in the table given hereafter.

In the beginning feed the chicks six times a day reducing the number to three when they are 3 to 4 months old.

Adults.—Separate the pullets and cockrels when they are 3 to 4 months of age. Do not allow the cocks to mate till they are 9 months old. The adults should be fed thrice a day regularly in the morning, noon and the evening.

The morning meal is always given in the form of scratch.

The Ration Table.

Kind of birds.	Scratch.			Mash.									
	Paddy.	Juar.	Wheat	Wheat.	Maize.	Oat.	Gram.	Juar.	Linseed.	Rice.	Offal.	Salt.	Bone-meal.
Hens ...	2	2	1	4	4	2	2	2	0	2	5	½	½
Pullets ...	2	2	1	2	1	1	1	0	0	1	2	1/5	1/5
Cocks and cockrels...	4	1½	1	1½	½	1	1	1	0	2	2	1/6	1/4
Chickens ...	0	1¼	1	2½	1½	1	1	1½	¾	1	0	1/3	1/5

Note :—All these figures denotes the number of parts to be mixed.

The following table shows the amount of food to be given per bird and the cost of feeding.

Kind of birds.	Amount to be fed per bird (per day mash plus scratch).	Feeding charges per bird per month.
Hens	4 ounces	Re. -/4/3
Pullets	3 ,,	-/3/-
Cocks and cockrels	3 ,,	-/2/9
Chickens	1½ ,,	-/1/3

Besides these mixtures, arrangements must be made to supply charcoal, grit, sieved clean sand etc. to the poultry.

The poultry diseases.—The danger of diseases of the poultry is one of the greatest problems in the success of a poultry enterprise. This itself therefore requires a separate article of its own, but I may say here that if proper cleanliness is maintained the trouble from diseases will be greatly reduced.

Always take prompt action if a bird is sick.

Isolate the sick bird and its neighbours separately and call for veterinary help.

A few important things.—Before taking up the enterprise have a thorough knowledge of the subject.

Keep only one best breed and the most suitable breed.

Do not rely too much on the servants.

Make proper arrangements for housing, feeding, watering, cleaning and disinfecting.

Renew the stock every year, never keep birds more than 2 years old.

Do not overcrowd the stock.

The following statement shows the annual income which may be expected from keeping 20 white Leghorn birds.

Expenses.				Receipts.			
Items	Amount.			Items.	Amount.		
	Rs.	A.	P.		Rs.	A.	P.
1. Feeding @ 20 lbs. per bird @ 40 lbs. a rupee	10	0	0	Sale of eggs from 192 doz. each egg weighing not less than 1½ ounces @ -/6/- per doz.	72	0	0
2. Housing Rs. 10/- charging 20%	2	0	0	Value of 50 adult birds at the rate of 1/- per bird	50	0	0
3. Labour	1	8	0				
4. Interest on capital	5	0	0				
5. Miscellaneous	2	8	0				
Total...	22	0	0	Total...	122	0	0
∴ Net profit = Rs. 100/-							

This high net profit will surely add to the purchasing power of an Indian farmer which will enable him to progress himself and in his progress lies the progress of India.

CAULIFLOWER

DHANNALAL

Botanical name.—Brassica oleracæ botrytis.

Natural order.—Cruciferae.

Vernacular name.—Gobhi, Phulgobhi.

History.—Cauliflower is said to have been cultivated for ages on the Mediterranean coast. It is regarded by historians to have its origin in Cyprus.

Season.—Cauliflowers are rather specific in their climatic requirements. They require a sufficient quantity of moisture with a constant cool temperature towards maturity. Rabi season is the best season for their cultivation as sufficient cool climate and a very humid weather prevail at the time for their maturity.

Varieties.—The strains, used on the College Farm obtained from seedsmen Messrs. Sutton and Sons, were (a) Early Snow Ball, one of the earliest of the imported variety largely grown, (b) Sutton's White Queen—In habit the plant is dwarf and compact and produces a most beautiful white solid head of large size.

Kind of soil.—When other conditions are favourable, it can be grown on any good soil but a fairly deep loamy soil is desired. Sandy loams or silt loams are preferred, although good clay loams are used. The soil should be well supplied with organic matter and must be well drained.

Manure.—In the first place, cauliflower is a gross—feeder and good crops can be grown only when the land has been liberally manured with Farmyard Manure. On the College Farm 20 Cartloads of Farmyard Manure is applied to an acre of land. Besides Ammonium Sulphate $2\frac{1}{2}$ to 3 mds + Superphosphate 3 mds mixed and applied before earthing up into ridges, and furrows have given good yield.

Too much nitrogen would induce vegetative growth and hence small flowers would be obtained.

Sowing.—Cultivation starts with the sowing of the seed in the Nursery and the seedlings from the sowing will have to be transplanted in the month of October. 9 to 12 ozs of seed is required for an acre of

land. One ounce of seed is supposed to produce as many as 1,500 to 2,000 plants out of which some are discarded due to their weakness and hence one will obtain 1,000 to 1.200 good seedlings for planting.

Nursery.—The seeds are sown out in beds which should be prepared in the month of August in an open place and should be about 5' × 5' for every ounce of seed sown. They should be raised fully one foot above the surrounding surface in order to secure good drainage. The soil should be friable and fairly rich but not highly manured. The seeds should be sown broadcast and covered over with ⅛" of light soil. It should be watered immediately after sowing in case the soil is dry, with a fine rosed watering can. Shades should be given to all sowing for a few hours during the hottest part of the day and also during the rainy part of the day. It is preferable that the seedlings should be planted in a second seed bed after 3 weeks before being finally planted to their permanent place. They are spaced about 3" × 2". Here they remain for 3 to 4 weeks when they should have 6 leaves. The seedlings will be ready for planting out in the field after 6 weeks from the time of sowing.

Cultivation.—The land for the ultimate reception of the plants should be ploughed deep and bakhered a number of times to get fine tilth up to a depth of 6". After thorough preparation of the land, the surface is levelled and then it is laid out in ridges and furrows 2' apart either with E. T. plough or by hand labour. The nursery area should be irrigated one day before the seedlings are removed in order that the soil may be softened and the seedlings removed without injuring their roots. After the lay out, the area should be irrigated and the actual transplanting should be done in the furrow, to begin with at the end of October. The best spacing required by the Cauliflower plants is from 18" to 20" from plant to plant.

Subsequent operations.—It should be clearly understood that the root system in this case occupies the soil very thoroughly and if the plant receive a check the result will be revealed either in "buttoning" i. e. the early formation of small unsaleable heads or "bolting" i. e. running to seed. Hence the field should be kept scrupulously clean of weeds. It requires 2 weedings and may vary according to the field conditions. Mulch formation with khurpies or hand hoes is very desirable to check the water evaporation as well as to bring the capillary water to the root zone of the plants. Earthings should be done in the month of December i. e. the furrows should be converted into ridges and the ridges ito furrows.

Irrigation.—Watering is to be done very carefully otherwise there is a danger of heavy loss. After the first irrigation which is given just before transplantation, two irrigations should be applied at close intervals i. e. 3 to 5 days to enable the seedlings to strike roots properly in the new place of their life. During the early period, watering is done after 8 or 10 days but later on after every 13 to 14 days. About 9-10 irrigation in all are given to the crop.

Blauching.—Blauching consists in checking the direct sun and rain from falling on head. The direct sun light and the rain water cause an undesirable colour to develope on the infloreseance. The cauliflowers are valued for their white colour but the development of other colours lowers the high market-value of the heads. Hence the following operation is done.

When the cauliflower heads attain a diameter of say 2 or 3 inches, the leaves of the plant are drawn over the infloresence and tied by means of string. In very healthy and vigorous plants the leaves may be damaged due to the cracking of the midribs. To avoid cracking, the rubber bands from the old inner motor tube may be used round about the cities where they can be obtained very cheap. They will last for several years if carefully used.

In the absence of all the above facilities. the older hard leaves of the same plants may be carefully cut from the stem and placed on the head. This is very economical but at times the plant growth is checked as the photosythesis is carried on by the leaves and when some of them are removed the plants manufacture less food material from the atmosphere.

In short, any thing may be used which can stop the direct sunlight and winter rain from falling directly on the flower. By carefully following this method, ideal heads will surley be obtained and a little trouble in so doing would add much to the profits.

Harvesting.—The main criterion in judging the maturity lies in observing the condition of the "curd" formed. The size of the plant is no index of the degree of maturity. This it will be seen that the plants form heads vary irregularly, while a few will be found 15 weeks from sowing. Good cauliflowers will begin to appear from 16 to 17 weeks from sowing or 9 or 10 weeks after planting out and will be ready for cutting at about 18 to 19 weeks of age.

Heads should be cut the day they are ripe for faults soon appear if harvest is delayed. Over mature heads tend to separate and become loose. A slight elongation of the ultimate branches the condition known as riciness and small heads though may not suffer in taste are objectionable in appearance. A good marketable cauliflower should be compact in appearance quite white in colour and from 6 "to 9" in diameter. They should be cut well below the head with a sharp knife or sickle, care should be taken to prevent injuring the heads in handling, either in the morning or late in the evening when the dew is on them. This will add considerably to their edible quality and to their period of freshness.

Yield.—Although the yield is much higher sometimes usually 4,000 to 5,000 good heads are obtained. About 1,000 to 2,[illegible]00 very inferior heads are also produced while the rest are of no use at all.

COST OF CAULIFLOWER CULTIVATION

			Rs.	a.	p.
(i)	Manuring :—		31	14	0
	(a) Cost of 20 C. L. of F. Y. M. @ 1/8	30 0 0			
	(b) Spreading charges 10 women @ /3/-	1 14 0			
(ii)	Preparatory tillage with bullocks and iron plough :—		5	6	0
	(a) 2 pairs of bullocks @ 1/8/- per day.	1 8 0			
	(b) 3 men @ -/5/- per day	0 15 0			
	(c) Depreciation and interest Area ½ an acre per day.	0 4 0			
(iii)	5 Bukherings :—		3	12	0
	(a) 1 man @ -/5/-				
	(b) 1 pair of bullocks -/12/- area 1½ acre.				
(iv)	Fertilisers :—		24		
	(a) Ammonium sulphate 240 lbs. @ 5/1/- per md.				
	(b) Superphosphate 240 lbs. @ 3/12/- per cwt.				
	(3) Spreading charges 2 men @ -/5/- each per day.				
(v)	Opening furrows with an E. T. plough and making beds and channels :—		2	15	0
	(a) 2 men -/10/-				
	(b) 1 pair of bullocks /12/-				
	(c) 5 men to mend 1/1/-				

		Rs.	As.	Ps.
(vi)	Cost of 11 oz. of seed @ 4/-/- and the charges for raising the nursery :—	59	0	0
(vii)	Planting :—	7	1	0
	(a) Uprooting of seedlings 2 men -/10/- (b) Selection of seedlings 1 man /5/- (c) Making holes 10 men 3/2/- (d) Planting seedlings 16 women 3/-/-			
(viii)	Irrigation	26	6	0
	(a) The depth from ground level to the water level was 20' to 25', 50 buckets of $1\frac{1}{2}$ gallon raising water 3000 gallons per hour were used. By means of this Persian wheel, one will irrigate one acre in about $1\frac{1}{2}$ days, working 8 hours a day. Labour units, 1 pair of bullock -/12/-: 2 men -/10/-. Hence for 9 irrigations the amount comes to Rs. 19/4/- (b) Depreciation and interest per acre per annum taking 8 acres to be managed under one Persian wheel costing Rs. 240/- = 4,9/6. (c) Depreciation on well costing Rs. 400/- =2/8/6.			
(ix)	Weeding and mulching :— ... .. 48 women @ -/3/- per day.	9	0	0
(x)	Earthing	3	2	0
(xi)	1 man to look after the crop for 2 months which includes harvesting of the heads as soon as they get ready.	20	0	0
(xii)	Land Revenue	5	0	0
(xiii)	Interest on Rs. 200/-@ $7\frac{1}{2}$ % and other overhead charges	16	10	0
	Total cost of cultivation ...	214	4	0
	Amount realised by sale of crop ...	300	0	0
	Hence the net profit is=	85	12	0

A SHORT NOTE ON THE CULTIVATION AND CURING OF CHEWING TYPES OF TOBACCO IN BERAR

Varieties.—One of the best types of tobacco for chewing is Pusa No 7. Seeds of this variety may be obtained either from the Imperial Economical Botanist, New Delhi, or from the Superintendent Government Experimental Farm, Akola, where this variety is being successfully grown, for the last 5 or 6 years. Another variety which has also been successfully grown on the Akola Farm is the Nadiad variety.

Propagation.—Seedlings are raised in a nursery and then transplanted on the field.

Nursery beds.—Nursery beds should be carefully prepared by digging the soil to a depth of one foot and after exposing the soil for a month or two making them into raised beds 8 ft long, 3 ft wide and 9 inches high. When the bed is ready, well rotted, cattle dung at the rate of 3 ghamelas per bed is mixed with the upper 6 inches of soil. A slight sprinkling of Ammonium Sulphate may also be given. The upper soil should be sterilised* to a depth of 4 inches. Split bamboos should be pitched in the form of arches over the beds so that by putting bamboo mats over them the beds may be protected from rain and sun. Five beds of the above mentioned dimensions will be sufficient tosupply seedings for planting an acre.

Seed rate.—One third of an ounce of seed will be quite sufficient for sowing the five nursery beds with.

Sowing.—Sowing should be thinly done. If there is overcrowding the seedlings begin to damp off and die. The seedlings should be two inches apart in the nursery. If they are found to be closer, then thinning should be done quite early. As the seeds are very small it is necessary to mix the seeds with ash or fine sand and then broadcast the mixture to secure even sowing.

Care of the Nursery:—Watering should be carefully done. Over watering results in the plants damping off. Watering should be done with a can having a fine rose. When plants begin to damp off spraying with Bordeaux Mixture will be an effective remedy. Certain Caterpillars also eat the young leaves. These should be hand picked. If this process becomes difficult then, Lead Arsenate will have to sprayed. Some fine soil should be sprinkled from time to time so that the roots on the surface are not exposed to the Sun.

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* To sterilise the soil heap over the bed stacks of tur, cotton, etc to a height of 9 inches and set fire. The heat produced will sterilise the soil.

Sowing time.—Seeds should be sown from the 7th of July to 21st of July.

Transplantation.—Seedlings are ready for transplantation when they are two months old. Seedlings should be lifted carefully to prevent as far as possible any damage to the roots. Transplantation should be done in the evenings. The places where the plants have to be transplanted should be kept watered previously.

Spacing.—Lines and cross lines 3 ft apart should be marked. At each of the points of intersection a single healthy plant should be planted. Caps made of teak-wood leaves may be used to protect the seedlings for a day or two from the fierce rays of the Sun.

Irrigation.—Watering will have to be done till the plants are established.

Interculture.—Weeding and hoeing should be done carefully. Parasite Orbanchæ, which may appear should be removed and burnt. All diseased plants should be uprooted and burnt.

Topping.—As soon the Apical and Axillary or extra Axillary buds come out the central shoot is nipped away leaving 8 to 11 leaves at the bottom. The object is to get 8 to 11 good thick leaves which almost come into maturity at one time.

Suckering.—As soon as the central shoot is topped or nipped, side suckers begin to develop. These should also be carefully removed.

Indications of maturity.—Leaves are ready for harvest when they begin to turn yellow and present certain swellings on the surface.

Time of harvest.—A crop transplanted in the middle of September is ready for harvest by the 15th December to January 15th.

Method of curing.—Ripe leaves are harvested and dried on the ground until the mid rib is quite dry. Then on a morning, they are collected when they are soft. They are heaped up and left for 4 to 6 days to undergo some fermentation and become quite pliable. If moisture is insufficient, water may be sprinkled. In order to prevent over heating the heap should be watched carefully and broken up and repiled.

Then 10 to 15 leaves are tied together into a hank. These hanks are well arranged and kept under moderate pressure under cover. These heaps are also rearranged every week to prevent over fermentation. The leaves will be considered to be cured and fit for chewing after two months.

Yield.—500 to 1,000 lbs of cured leaves are obtained per acre. These will sell at Rs. 4/- to Rs. 4/8/- per maund of 21 lbs.

Extracts

GREAT IRRIGATION WORKS

An All-India Survey

The following note on the Irrigation in India is issued by the Deputy Director of Public Information:

Irrigation—without which a sixth of the crops would fail and hundreds of thousands of people would be reduced to starvation of India—is to be surveyed as a whole in order to calculate its numerous indirect benefits to this country.

Artificial irrigation is by no means one of the country's recent activities—she has practised it from time immemorial and is even said by some to be its original home. This, however, was irrigation of a primitive kind from tanks and wells. The Hindu and Muhammadan rulers improved matters to some extent, but the few dams and canals they built were of an elementary type. They are dwarfed into insignificance by those of the British regime in both magnitude and efficiency.

It is seldom realised abroad—it is even little known in India itself—that the acreage irrigated in India exceeds the combined total of that in six countries which stand next to her in the list of the world's largest irrigation countries including the United States. This acreage, traversed by some 79,000 miles of Government channel alone, has now reached the colossal figure of 40 millions and provides direct employment for no less than 50 million people, or a seventh of the country's population.

Another figure which conveys an idea of the immensity of irrigation operations in India is the quantity of water used for this purpose daily,

It works out to the almost unbelievable total of about 260.000,000,000 gallons, equivalent to the flow of roughly 100 rivers the size of the Thames in London during the winter.

Sukkur Barrage System.—It is not in irrigated area alone that India leads the way—her irrigation projects are among the largest in the world in many respects. Much has been heard recently of the vastness of the Sukkur Barrage system one of the largest, if not the largest, ever undertaken by man, which commands an area 1½ times that of Palestine. This, however, though justly famous, is only one of several schemes of almost equal magnitude—to say nothing of hundreds of smaller ones—to be found in India. In fact, there is at least one scheme, the Lower Chenab Canal in the Punjab, which, on the basis of the figures of 1934-35, the latest available, actually irrigated nearly 2⅓ million acres or about 440,000 acres more than the area actually irrigated by the Sukkur Barrage canals in the same period. There were six other schemes each of which watered over a million acres that year and several which closely approached that figure. The Sutlej Valley Project alone, which is among the great schemes just mentioned, serves an area exceeding the total cultivable acreage in Egypt and the Sudan. The Sarda Canal in the United Provinces commands an area equal to that acreage.

In length of waterways too, many Indian schemes rank high, even very high. Here the palm goes to the Lloyd Barrage System with its 6,500 miles of main canals, branches, distributaries and minors; but the Cauvery Delta System is only 1,100 miles shorter and four other systems total 3,000 miles each. How many projects in other parts of the world can equal these?

Colossal Indian Dams.—In respect of dams, India is also well to the front. The Lloyd Dam at Bhatgarh in the Bombay Presidency (which, incidentally, has no connection with the Lloyd Barrage System in Sind) contains 21½ million cubic feet of masonry, and in this respect surpasses the famous dam at Assouan in Egypt, which is so much talked about. Though some 2,000 feet shorter than the latter, the Lloyd Dam is 70 feet higher than it. There is also the Wilson Dam at Bhandardara, another work in the Bombay Presidency, which, though not quite a mile long, towers up for 270 feet and is one of the highest dams in the world. For length, however, pride of place must given to the Nizam Sagar Dam in the Hyderabad State and for cubical content to the Mettur Dam in

Madras. The former is just under 16,000 feet long and the bulk of the latter is nearly 54,700,000 cubic feet. These again are astounding figures.

Several of the Indian works are characterised by originality of conception, boldness of design and excellence of execution. Prominent among them is the Great Ganges Canal in the United Provinces with a total waterway of over 4,000 miles, a flow capacity of 8,000 cubic feet a second and a gross command of nearly 5½ million acres. It passes over and under a very large number of torrents, rivers and other channels and embodies the famous Solani aqueduct, one of the finest engineering feats of its kind in the world.

For its novelty, the Periyar Dam in the Madras Presidency is worthy of mention. Built under great difficulty in a narrow gorge 3,000 feet up in the Western Ghats, it has diverted a river eastward from the Indian Ocean into the Bay of Bengal by means of a tunnel over a mile long, or about 5 times the length of London Bridge, bored through solid rock.

Equally remarkable are the head works of the Cauvery Delta System, comprising a 4 weirs of a total length of 2¼ miles and nearly 1½ miles of embankment.

Cost of Works and the Returns.—As may readily be imagined, the cost of these gigantic works has not been light, notwithstanding the cheapness of Indian labour. The total capital outlay up to date is in the neighbourhood of 150 crores of rupees or roughly £ 100 million at the official rate of exchange. This money, however, has been well spent, for the value of the crops raised with the assistance of irrigation is in the vicinity of Rs. 100 crores or £ 67 million annually. The gross revenue amounts to about Rs. 13 crores or £ 8,660,000; the working expenses to Rs. 5 crores of £ 3⅓ million and the net revenue therefore to Rs. 8 crores or £ 5⅓ million. This represents a return of about 5½ per cent, which is a remarkable figure considering that a large proportion of the projects constitute what are known as "protection works" that is, schemes designed to protect tracts against famine, not to yield profits.

Up to the present the financial requirement of new schemes has been that they shall pay 6 per cnt. The Central Board of Irrigatien, which is a new body and typical of a new spirit among engineers, has launched a survey to estimate the gross value of irrigation schemes in the way of

revenue from all sources, for such schemes spell not only an increase of land revenue and water rates but also enhancement in railway, postal, customs receipts, to mention only the more obvious "subsidiaries". The object in view is to obtain more generous advances for new projects than is possible under the present restriction practice.

Benefits.—The benefits which irrigation has conferred on the country cannot be measured in terms of money or increase of cultivation alone, although these are the most tangible and readily computed. But some idea of the advance made during British administration may be gleaned from the following figures. Before the advent of British authority in India, when little had been done in the way of large irrigation works, the area under irrigated cultivation would not have exceeded a couple of million acres or so, though accurate information is not forthcoming. This had risen to 10½ million acres in 1878-79, and to 19¼ million acres by the beginning of the present century. 30 years later it stood at 31.7 millions the highest reached so far. These figures exclude cultivation in Indian States and moreover relate only to areas irrigated by Government canals. There are large tracts irrigated by both Government and private tanks and wells, which cannot be overlooked. In 1934-35 the area under well irrigation was approximately 12.6 million acres.

Many of the large schemes in the Punjab, notably the Triple Canals and the Sutlej Valley Projects, have resulted not only in increasing cultivation, but also in relieving the pressure on thickly populated regions by transforming desert, uncultivable or difficult land into fertile agricultural areas. This process is being extended and is yielding very satisfactory results from every point of view.

Peep into the Future.—Looking to the future, Irrigation Engineers and Local Governments are taking up the question of developing electricity at irrigation works and of irrigation by means of tube wells. In connection with the former, much has already been done in Madras on the Cauvery Mettur System, while a comprehensive grid system is in operation in the United Provinces and another is in process of completion in the Punjab. Moreover, with an eye to the future, many of the schemes completed in recent years contain provision for the generation of hydro-electric power, should this be decided upon later. This development holds great possibilities.

Tube-well irrigation too, has already been initiated in some provinces, It has found particular favour in the United Provinces, which contain the largest tracts of fertile land in the country and constitutes the centre of the growing and prosperous sugar industry. In 1934-35, 255 wells were in operation and irrigated 31,831 acres. The figures for the following year had risen to 743 and 118,730 acres respectively. Last summer 814 wells were working and 1,500 are expected to be working next summer. Much is hoped for, from this scheme.

Another proposal under consideration is the setting up of a Central Research Station under the ægis of the Central Board of Irrigation to deal with the many, varied and urgent problems that confront irrigation experts. Here, such matters as the meandering of rivers, seepage and water logging will be investigated and the results made available to all the provinces. There can be little doubt that such a Research Station will be of incalculable value not only to the irrigation engineer, but also to the cultivator and the exchequer of the country.—*(Hindu August, 18, 1937)*.

CUT FLOWERS

MRS. A. H. KELLER, YANDIAH.

Early morning, while the air is fresh and cool and the flowers are laden with dew, is the best time for cutting flowers, as the plant absorbs moisture all night long. A sharp knife, using a slanting upward cut, makes a clean cut without injuring the stem. If the stem, which acts as a tube to supply water to the leaves and blossoms, is crushed, the supply is unable to ascend and the flower soon withers. Hardy wood stems may be cut with sharp shears.

Ordinary scissors should not be used for cutting. The slanting cut opens a larger surface to the water and prevents the cut surface from resting flat on the bottom of the vase, thereby impeding the absorption of water. Woody stems should be split two ways, for about one inch or the bark scraped or lacerated. As soon as the flower stem is cut and exposed to the air, a certain amount of air is absorbed, which later impedes the fullest influx of water. If the cutting is done under water, the new tissue will absorb water rather than air. A good suggestion is to carry a bucket of water to the garden, and, when cut, the flowers are immediately plunged nto it to the full length of their stems. Thus, they have no chance to

start wilting. Then stand the pail in a cool, dark place for 2 to 3 hours, 6 to 12 hours is not too long, as it allows them to drink themselves completely full of water.

Flowers need fresh air and should be moved out of a room while sweeping and dusting. They should not be in a draught, as it induces evaporation faster than the stems can supply moisture. Some of the foliage should be removed to cut down evaporation; also, that which would be below the water, as it will decay and polute the water. If all the leaves are removed from Poinsettias they may be kept much longer. The best authorities agree that flowers should have fresh water daily, and the stems should be freshly cut, as some stalks seal themselves in the same way that the edges of a wound draw together. Some florists add 5 to 20 drops of formaldehyde, depending on the size of the vase, to the water in which they first put the flowers and let them stand before arranging them. For flowers in full bloom, 5 grains of aspirin to a gallon of water has been found successful by many. If bought flowers do not look very fresh, cut off the ends of the stalks and dip the latter into hot (not boiling) water for 10 minutes. The flowers are then put into carbonated water, which is made by putting a pinch of carbonate of soda into water and stirring. It is also claimed that if a few drops of camphor are added to the water it aids flowers to absorb water more rapidly. A piece of charcoal added will help to keep the water sweet. If post-sent flowers have the stalks inserted in small pieces of potato, they will arrive in a fresh state.

Many flowers, especially Poppies, will stay fresh longer if their stems are sealed by plunging them into boiling water, or by scorching the ends. Having cut the flowers, do not just gather them up and push them tightly into a bowl. A major fault is over-crowding. The Japanese use flowers very sparingly just a few blossoms or sprays loosely arranged, so that each may be seen. They choose stems which bear leaves, flowers and buds, and after arrangement in the vase, every surplus leaf or bud which prevents every part of another being seen is snipped off with scissors.

Another of their rules is that the length of the stalk shall not be greater than one and one-half times the height of the vase. An odd number of flowers is more pleasing than an even number. Green foliage combines with most blooms, and some white flowers, especially the lacy ones, look nice with highly coloured ones. Vases as a rule should

harmonise with the flowers, although some contrasts are quite good Clear glass is always a safe selection. Wild flowers look best in plain earthernware jars.

Always try and pick up in the flowers the colour of something in the room. Often the predominant hue in a vase of blooms will match the curtains or the design of the carpet and, with a little thought, it may be so placed as to accentuate the best-liked tones of the room's furnishings.

INDIAN WHEAT

Problems of Marketing

MR. N. C. MEHTA'S SURVEY.

A survey of the problems connected with the production and marketing of wheat in India was made by Mr. N. C. Mehta, Vice-Chairman, Imperial Council of Agricultural Research, in his opening address to the Wheat Committee of the Council which met at Simla on the 9th September.

"There have been unmistakable indications during the past few months that we have at last emerged from the depressing period of economic malaise." "So far as wheat is concerned," Mr. Mehta said, "India has again appeared in the London market as a substantial exporter of wheat. 231,000 tons roughly equal to the average value of exports of the post-war quinquennium were exported in 1936-37. While this is a matter for gratification it must not be forgotten that the averages of export for the pre-war and war periods were 1,308,000 and 807,000 tons respectively. It is well known that our exports are primarily a matter of prices and we are from the point of view of economic efficiency by no means a chief producer of agricultural commodities, particularly wheat. The reasons are not far to seek; they lie deeply embedded in our social and economic organisation. While on the side of production considerable advance has been made in developing high yielding strains which have found widespread acceptance all over India, we nave not progressed *pari passu* in the matter of financing and efficient marketing of the crop. This latter problem is now being systematically dealt with, by the Agricultural Marketing Adviser. The magnitude of the problem is well set out in the Marketing Report on wheat. The problem in a nutshell is how to narrow the margin which the cultivator at presen

has to part with, in favour of the intermediaries between the producer and the consumer. This fraction is at present as much as 40 per cent.

"Marketing problems have recently loomed large, for efficient marketing ultimately means the rationalisation of our existing economic organisation. Once the question of production has been attended to, we have to deal with numerous and varied adjustments which must be carried out with the minimum of waste and the maximum efficiency. The extent to which the resources of modern science are being pressed in the service of our somewhat primitive agriculture is seen by the fact that arrangements have already been made since October last for weekly broadcasts of Wheat and linseed prices. 'Ready' and 'forward' quotations obtaining at Hapur are broadcast daily from the Delhi Station. This market news will be even more valuable when we succeed in achieving uniformity of weights and measures throughout the country; for their confusing multiplicity and diversity are at present a great handicap in the dissemination of useful and generally intelligible market information. This simple but enormously important matter deserves urgent and careful attention of the people in the trade as well as the Governments in the provinces.

Quality Standards.—"In this connection a recent suggestion of Sir John Russell, whose admirable report on the work hitherto done by the Imperial Council of Agricultural Research will soon be available, is worth notice especially at the hands of the marketing staff. However large the quantum of wheat exports may be in future, there can be but little doubt that it will be but a small fraction of the total production. It is therefore but proper that quality standards of wheat should primarily be considered with reference to our own internal requirements. In other words, wheat grading will have to be looked at from the point of view of the Indian *chapati*. This however does not exclude the exploration of suitable standards for the export market.

"As you are aware, a certain amount of progress has already been achieved in the preparation of a standard contract form as a result of an informal conference between the representatives of the grain trade and the central marketing staff. If this is adopted, as there is every hope, it should facilitate the transactions between the various internal markets. I may also add in this connection that these personal contracts with

the people in the trade have been of immense value in getting a proper perspective of the problem and in devising ways and means to rectify the defects in the existing organisation. The question of storage was considered at the last meeting of the Committee and the scheme of the ferro-concrete chambers, which I had the privilege of initiating in Muzaffarnagar in 1935, was recommended to the various provinces. From the figures worked out and published in the Wheat Report it would appear that the cost of storage in ferroconcrete pits for a period of eight months is 1.4 pies per maund as against 2.1 in *kachcha* pits and is less than half of the cost of storing in *kothas* and less than nine-fourth of the cost of storage in bags. I do not however know what further progress has been achieved in respect of providing more efficient storage, but there can be little doubt as to the need for adequate up-to-date storage especially in the principal wheat markets in the country."

Progress of Research.—Proceeding, he said that the report of Sir John Russell regarding the work of the Council on wheat made it clear that there were a number of problems of great practical importance which required to be investigated in the provinces, for instance, the great difference between the seed rates of the Punjab and the United Provinces, and the considerable divergence in the matter of yields which inevitably affected production costs and the return to the cultivator. " Sir John Russell has admirably summarised the experimental work on wheat which has been carried out in this country during the past half a century. I heartily endorse his suggestion for the preparation of a comprehensive monograph on Indian wheats; for at present the literature on the subject is not easily available and there has been no attempt at which a monograph since Howard's 'Wheat in India' was published in 1915. In the opinion of Sir John Russell the modern improved Indian wheat compares favourably with good Australian, Canadian and South American samples and there is no reason why this brilliant work should not be more widely known. For example, one of the most outstanding achievements is the wheat cross C.591 in the Punjab which is one of the finest eating wheats and also beautiful in appearance. It was introduced into general cultivation in the Punjab only two years ago but in 1935-36, 81,000 maunds of seed were distributed sufficient for 135,000 acres leaving an enormous unsatisfied demand. In Bombay, in Sind and in the Central Provinces a number of useful strains have been evolved which are high yielding and rust resistant. Rust is a serious

disease of wheat in India. The entire question of rust resistance is being studied by Rai Bahadur Dr. K. C. Mehta since 1930 and a sum of about Rs. 230,000 has been already spent on the experimental work carried out under his direction. A great deal of useful data has been collected and I hope that it will be possible at an early date to collate the data and to work them up into a comprehensive monograph. This is extremely important, specially in the case of a long-range research of this nature for unless the results are analysed and put together at regular intervals, there is serious danger of the researcher being lost in the ever-increasing growth of his own data. The whole question of rust resistance has to be surveyed both from the view points of particular localities or provinces and also of the country as a whole. The work has met with the approbation of Sir John Russell and what is now wanted is that we should carefully survey the results already obtained and apply them to the solution of practical difficulties as far as possible. Dr. Mehta has already made specific proposals with a view to mitigate the damage done by rusts; for complete eradication is not possible. It seems to me that the time has now come when work should be carried out to ascertain the extent to which these proposals can be put into practice.

Statistical Data.—" In conclusion, I must not forget the all important question of collecting accurate statistical data a subject which has been repeatedly discussed. The problem is far from easy, especially in permanently settled tracts. The only practicable course in the circumstances is to make use of the method of random sampling as far as possible. The work, however, is one primarily for the provinces to carry out and the Council can only make proposals for such a survey as a result of its own xperience in various parts of the country."—(*Hindu*).

GRADING OF EGGS

Work of Experimental Stations

The preliminary survey of marketing of eggs in India has indicated the desirability of effecting improvements in the existing wasteful methods of preparation, treatment and handling of eggs for market, says a Press Note issued by the Director of Public Information.

The practice of selling dirty, stained, cracked and stale eggs mixed with clean, sound and fresh ones is found to be common throughout the

country. Moreover, eggs of varying sizes are mixed together indiscriminately. This not only involves considerable expense to the merchants in testing and sorting out eggs of doubtful quality at the terminal markets, but also means delay in speedy disposal of eggs. Besides, the consuming public cannot be sure of the quality of eggs they are buying. In order to prevent the waste and to provide to the consuming public eggs of defined quality, the work of grading of eggs was started in India in November last under the control and guidance of the Agricultural Marketing Adviser to the Government of India. Two grading stations have been started as an experimental measure in the heart of egg-producing areas in close co-operation with the local egg merchants who have been supplying fresh eggs regularly for the purpose of grading. One of the stations is located at Pabbi in North-West Frontier Province and the other at Changannur, recently transferred from Kottarakara in Travancore State. Twenty lakhs eggs have been graded at the two stations up to the middle of June.

How Grading is done.—It may be interesting to describe the work at Egg Grading Stations. As the eggs arrive from neighbouring villages, they are examined by the merchant, and cracked and broken eggs are removed. The eggs are then taken to the grading, stamping station for cleaning, testing, grading, stamping, packing, labelling and sealing. Each egg is examined with a view to removing taint or stains on shell as well as for normal shape and texture of eggs and then tested for freshness and other quality points by means of candling apparatus specially designed for the purpose. Eggs which pass the candling test are taken to the grading machine for sorting them into different grades. The grading machines are the first of their kind in India obtained from England. The machines are set to sort out eggs with unfailing accuracy according to the weight into four grades *viz.*, Special, A, B and C. The minimum weight for each grade is $1\frac{7}{8}$ oz. for special, and $1\frac{3}{4}$ oz. for A, $1\frac{1}{2}$ oz. for B, and $1\frac{1}{4}$ oz. for C, as prescribed in the Grading and Marking (Eggs) Rules, 1937, framed under the Agricultural Produce (Grading and Marking) Act I, 1937. Such eggs as do not conform to the specification given in the schedule appended with the Rules are rejected and returned to the merchant, since the basis of the scheme is that any one selling agricultural produce with grade designation will offer for sale the goods of the defined quality.

The eggs thus graded are stamped, showing grade designation Special, A, B, and C, on each egg. The stamped eggs are then transferred

to clean containers and packed by the merchant according to different grades in the presence of the Officer-in-charge of the Grading Station. The packages are then sealed and labelled by the grading staff. The seal bears the mark 'AGMARK' which cannot be used by any person without specific authority. Each label bears full particulars regarding grade designation, number of eggs contained in the package, net weight, name of the grading station and date of despatch. Attempts are also being made to introduce improved methods of packing and improved types of packages so as to prevent waste on account of breakages and other losses incurred by the merchants owing to eggs becoming stale in transit.

In short, the whole scheme aims at supplying a better and standard quality of eggs to the consumer at a reasonable price and also obtaining a better return to the producer and other agencies engaged in the trade.

The experience gained so far has shown that there is an increasing demand for graded eggs and it is hoped that their growing popularity will not only result in the achievement of the aforesaid objects but also lead to the expansion of the egg trade generally.—*(Hindu)*.

COW'S MILK FOR INFANTS

Proper method of feeding

While the present general interest in various aspects of cow's milk as a food and as a commodity has never been exceeded, the question of the best form of its administration to infants has not received much attention recently (says a note in the 'Lancet' of Aug. 21.) There is still much difference of opinion in this country among paediatric experts, all of whom would, however, agree that with differing formulas they have the same object in mind—namely, to give the baby who must be fed in an unnatural manner the most satisfactory dietetic mixture.

While experts disagree, the practitioner remains fretted by such problems as when (and when not) to use sodium citrate; what is humanised milk; and are Truby King nurses always right? The Council of Foods of the American Medical Association has recently attempted, by authoritative surveys, to help those who are confused. One concerns the question of curd digestibility, this being the part of cow's milk which is most likely to disturb the human baby's stomach. Tests on what is termed "curd tension" have been carried out over a number of years, the method being to coagulate milk by a solution of pepsin and measure the force required to

pull or push a knife blade through the resultant curd. With raw milk this tension is usually high, although there are many variations between the products of different cows. The modification of the curd, which means in effect reducing the curd tension, can be achieved in many ways, of which boiling, dilution, and the addition of acids or alkalis, in that order, appear to be the most effective measures. Similiar conclusions were reached by H. L. Wallace in an address delivered to the Edinburgh obstetrical Society earlier this year. Wallace had also conducted certain tests on milk which was clotted by the addition of rennin; he found that after dilution by water and boiling the size and toughness of the milk curd were so reduced that there was no advantage in adding sodium citrate. The addition of partially dextrinised starchy food to milk did not in these Edinburgh experiments affect the size and consistency of the clots. Dried milk prepared by the roller process produced a fine precipitate, but in the specimens dried by the spray process that were tested in Edinburgh there was some clotting although the individual curds were comparitively small and soft.

Boiled and diluted milk best.—The application of such experiments to every day problems of infant feeding is carried a stage further in the American reviews by a survey of certain clinical experiments. These show that in general, milk with a low curd tension is less likely to be delayed in the stomach and such digestion as takes place in the stomach is more quickly accomplished when curd is soft. On the whole the best digestion appeared to be obtained with ordinary boiled milk, and there seemed no obvious advantages, as far as clinical observations went, in making special additions of acids and alkalis or patent foods. This conclusion is in accord with that reached by Wallace--namely, that fresh cow's milk boiled, diluted with water, and containing added sugar and cream in the required amounts is a good programme, although from other considerations Wallace concludes that a good variety of dried milk is probably the best available substitute for human milk. There is thus agreement on one aspect of infant feeding The next step is to settle the important question of the degree to which cow's milk should be diluted for infants.—(*Hindu*).

FRUITS AND VEGETABLE STORAGE TRIALS

Gas storage of Bartlett pears.—The term "gas storage" refers to a method of storing fruits in low temperatures in an atmosphere in which the normal concentration of carbon dioxide has been raised and the

normal concentration of oxygen has been lowered. The changes in concentration of these two gasses are brought about by the fruits themselves. The proportion of the two gasses is kept within safe limits by controlling ventilation.

Bartlett pears have been used in gas storage experiments through several seasons and the following variable factors have been checked. Maturity, seasonal and soil differences, temperature, humidity and the composition of the storage atmospheres. Under experimental conditions it has been possible to store Bartlett pears for about ten months. Under conditions of ordinary cold storage it is difficult or impossible to hold this pear for the Christmas market. Semi-commercial trials are to be started with the current crop.

Waxed fruits and vegetables.—During the past three years there has been an increasing use of waxes as a surface covering for both fruits and vegetables. They are waxed in order that they may pass through retail markets in better condition than they normally do. Several factors appear to be of utmost importance in the process of waxing. Among these, are the kind of wax, the temperature of application, the amount applied and the condition of the fruit or vegetable.

Preliminary work has been done here with tomatoes and apples but the demand for information on the waxing of turnips, carrots, parsnips and beets made it necessary to concentrate the work on those vegetables. Fairly satisfactory results have been studied in some detail. There remain several unsolved problems in connection with the large scale handling of these root crops.

Frosen-pack fruits and vegetables.—Frosen-pack fruits and vegetables is an important industry especially in the United States of America and it is rapidly increasing in importance in Canada. The process requires that the fresh fruits or vegetables be frozen quickly and held at a freezing temperature until used. Fruits are covered usually with a sugar solution before freezing and at no time is any heat applied. All vegetables, on the other hand, require blanching in boiling water or steam for periods ranging from one minute to six minutes. Following the blanching they are cooled immediately, packed dry or in 2% to 3% brine and frozen quickly.

The experimental work here is concentrated upon a study of the suitability of commonly grown and new varieties of fruits and vegetables

for freezing. The success of frozen-pack products depends primarily on the varieities used for the purpose and most of the common varieties are not well adapted for freezing. However, we know at least one variety of strawberries, rasberries, peaches, cherries, grapes, peas, corn, asparagus, cauliflower and broccoli which may be frozen fairly satisfactorily. About a hundred and fifty varieties have been tested and the work is being continued. Full information is available upon application to the department. *(Extract from the O. A. C. Review, Vol. XLIX issue No. 8 of Midsummer 1937.)*

India's Livestock.—The report of Dr. Wright on the development of the cattle and dairy industries of India, just published, is a valuable document. It embodies the results of what is perhaps the first comprehensive enquiry into our livestock resources conducted by two experts. The investigation has served to underline what was quite familiar to many observers. It has shown that in her livestock, India owns a source of wealth as important as agriculture. Dr. Wright estimates that the dairy products of this country are worth annually about Rs. 300 crores—which is equal to the value of our total annual rice production. To this, must be added the return from draught cattle and cattle manure. On the whole, Dr. Wright places the total value of animal products of all kinds in the region of Rs. 1,000 crores a year. That in spite of these vast resources, our per capita consumption of dairy products is lower than that of many other countries is another fact brought home to us by the present enquiry. It is well known that milk consumption in this country is much below the minimum amount necessary for physical development and maintenance of health. Dr. Wright insists that there is immediate need for increasing milk production to at least twice the present output. He makes detailed suggestions for bringing about this increase, including the establishment of Department of Animal Husbandry in the Provinces and the setting up of a Central Dairy Institute. Dr. Wright's proposals are intended to solve two basic problems: the improvement of livestock and the better organisation of the dairy industry. The first, it is obvious, is the more urgent problem. For its successful solution a variety of questions have to be tackled. Indian cattle, like the Indian people, are generally underfed. Veterinary aid is anything but adequate and the improvement of breeds is only just beginning to receive attention. It may be seen, therefore, that the task confronting the authorities is a stupendous one. The existence of Congress Governments in many

provinces inspires the hope that the task will be courageously discharged. We commend Dr. Wright's proposals to the earnest consideration of Provincial Governments throughout the country. There is a great duty before them; but the reward of its fulfilment will be no less great. *(Hindu).*

INDIA'S POPULATION PROBLEM

Plea for assisted emigration

The problem of India's population was discussed by Professor Radhakamal Mukerjee, of Luknow University, in a paper read before the Royal Society of Arts in London.

Analysing the country's food supplies in relation to its population, he said that the amount of energy contributed to Indian food requirements from all sources was 250.1 billion calories, compared with the minimum need of 292 billion. Relating this figure to population, Professor Mukerjee found that assuming the rest of the population received its daily ration, 48,000,000 persons would be without food.

Under the most complete expansion of cultivation, which was impossible without the adoption of a vast measure of land reclamation irrigation and strenuous efforts characteristic of the Chinese peasantry, India's total population could not be above 447,000,000. By the middle of the century assuming the present increase continued, this figure in all probability would be over-stepped. He was of opinion that a definite decline in the standard of living could be expected in these provinces showing the largest disparity between the increase in population and the value of agricultural production.

Emigration.—Dealing with the question of migration, Professor Mukerjee said that India, like Japan, should adopt a scheme of assited emigration overseas defraying the cost of passages of emigrants to undeveloped foreign countries.

The British Empire should deal with the question as an essentially Imperial problem. Imperial economic planning could not be successful without modification of racial discrimination and the policy of no Indian emigration to Australia or South and East Africa. As long as 400,000,000 Indians were not freed from the cramping effects of economic pressure,

and soil expansion on their two acre holdings, their low purchasing power would prevent the industries of Great Britain from emerging successfully out of the present depression.

The Imperial Conference had the appropriate machinery, which, if boldly used, could formulate reciprocal agreements between different parts of the empire. These might, through a more liberal emigration policy, increase the imperial food supply and trade and level up the standards of living among the different peoples.—(*Times of India.*)

NEWS FOR TOMATO GROWERS

Dr. Carver, the famous Negro scientist of Alabama. U. S. A., has shown that the finest tomatoes can be grown from "cuttings." He has pointed out that six inch cuttings taken from the lower branches of the growing plant, and set out in the ground, root in nine days' time, and begin throwing out leaves almost immediately afterwards, and then flower and fruit. The whole period of growth from the planting of the cuttings until the harvest of the crop occupies only 2¼ months on against 3½ to 3¾ and 4 months, when the tomatoes are grown from seed.

Mr. Crosley adopted this plan lately in Hyderabad, and was surprised at the rapidity with which the cuttings took root, threw out leaves and blossomed and fruited. The vigorous growth of the plants thus raised leads Mr. Crosley to believe that this method of propagation can be adopted successfully with the very best varieties of tomatoes like Ponderoza, Oxheart, Matchless, Stone, etc., at little expense and much saving of time, and will not only furnish supplies of this vegetable when not usually available, but will make them cheap besides enabling tomato growers to dispense with seed altogether after the first sowing. (*Times of India*).

USES OF LEMONS

What drink is nicer in summer than a cold lemon squash, and in winter a hot lemon drink? With 2 aspros it is very good to break up a cold. The juice of 3 lemons, undiluted, and without sugar, will generally stop vomitting. Lemon juice in hot coffee relieves a headache. Equal parts of lemon juice and glycerine are excellent for an irritating cough. When cooking prunes, add the juice and rind of ½ lemon. To remove iron rust quickly and easily from any material, invert a medium heated rion, place, on it the stained fabric and gradually squeeze the juice of the lemon on the stain. The mark will be carried away by the steam. The

juice of lemon added to blue rinsing water when washing white silk will keep silk pure white. Stains in hands can be removed by rubbing with lemon juice. A few drops of lemon juice on the tooth brush keeps the teeth perfectly white. Before squeezing lemons, place them in the oven for a few minutes, and twice as much juice can be extracted. The use of lemon juice in place of vinegar on fish, tomatoes, beet, etc., is a valuable digestive aid. A teaspoon of mixed spice in hot lemon will often break up a cold. (Secretary, Mrs. P. Founlis).

RISK OF CHEWING "PAN"

Cancer of Cheek

Excessive chewing of *pan* is responsible for a large group of cases of cancer, according to the annual report of the Patna Radium Institute for 1935-36.

The habit of constantly chewing *pan* with lime and tobacco and keeping the chewed mass in the mouth against the cheek is responsible for a large majority of cases of cancer of the cheek. The habit of 'khaini' (keeping a quantity of powdered raw tobacco-leaf mixed with lime on the inner side of the lower lip) is also responsible for a large number of cases of cancer of the lip and jaw.

The report states, "Although we have no definite knowledge as to the exact cause of cancer, still in a large majority of these mouth cases the existence of the disease can be definitely traced to the presence of some kind of constant irritation. There is often an interval, frequently of years, before the disease shows itself. The majority of cases are between the ages of 40 and 60, and in most of them the habit had been in existence for years before.—(*Associated Press*).

SALT PREVENTS ILL EFFECTS OF HEAT

A serious problem to many of the important industries of the country is the effect of extreme heat on employees. In mills and factories where of necessity high temperatures exist, the problem of heat cramps and heat prostration is especially acute. Cramps and prostration, however, are frequently met with in the hot months of summer where workers are unprotected from the direct rays of the sun, and, for that matter, even in mills where the temperature is lower than that of the outside air.

The use of salt as a remedy and preventive measure in such cases is several decades old, but only recently has its effectiveness been scienti-

fically proved by successive trials. One of the most recent and thorough investigations of the value of salt as a heat prostration preventive was made by the Fatigue Laboratory of Harvard University, conducting experiments both at home and in the field. More than five years were spent in gathering data on the physiological and pathological effects of high temperature on workmen.

Dr. Arlie Bock, who is connected with the Harvard Fatigue Laboratory, suggests that a worker, working eight hours a day under extreme heat, should use plenty of table salt with his food and also should take five or six one-gram tablets of salt, enteric coated to prevent dissolution before the tablet leaves the stomach.

Salt tablets solve prostration problems. Since salt tablets have been made available several automobile plants have not had a single case of heat exhaustion. The tablets, each containing one teaspoonful of pure sodium chloride, are available at drinking fountains in many of the factories. They are swallowed whole, followed by one or more glasses of water. Holding that the principal cause of heat exhaustion is the loss of salt from the blood stream through profuse perspiration, Dr. E. R. Harris, physician at the Cadillac motor plant, is urging shop workers to take from 10 to a dozen of the salt tablets daily.—(*Scientific American, Sept. 1937*).

OAT FLOUR PREVENTS RANCIDITY

Rancidity in foodstuffs is known to be caused by the action of oxygen on fats and other compounds in them. To overcome oxidation, a number of synthetic chemicals have been found effective, but most of these are of such character that they cannot be added to foodstuffs. Recently it has been found that oat flour possesses to a remarkable degree the power to suppress the changes in foodstuffs which result in rancidity. The oat flour may be mixed directly with the fat or other foodstuff, or may be used to treat the wrapping material of the food package. A small amount of oat flour (1 to 5 percent) incorporated into a surface coating on paper has been found effective. Treated paper has been used successfully for wrapping butter, lard, bacon, cereal products, potato chips, salted nuts, and coffee, among others.—(*Scientific American, May 1937*).

CONTROLLING GROWTH OF WEEDS

Sulphuric acid spray as a method of controlling the growth of weeds in fields of grain is gaining ground in the United States. Tests covering several years and several thousand acres of grain

fields in California have demonstrated the effectiveness of this method. During the present season more than 6,000 acres are being kept free from weeds by spraying with solutions of sulfuric acid which kill weeds but do not injure the growing grain.

This is a meagre beginning when in California alone there are more than half a million acres that could be benefited and when the vast grain fields of the Midwest and the Pacific Northwest have not yet been touched. In France the treatment is already applied to more than 500,000 acres and its use is growing in England and on the Continent. The California development includes testing new, more efficient types of sprayers over larger areas more effectivly.—(*Scientific American, Sept. 1937*).

PERMANGANATE IN FERTILIZER

Addition of potassium permanganate in small amounts to fertilizers has been found in England to increase the yields of radishes lettuce, and other vegetables. It also has the effect of removing moss, and earthworms from lawns, which suggests its use on the greens of golf courses. Presumably one of the effects of this powerful oxidizing agent is to convert organic nitrogen to nitrates in the soil as well as to supply small amounts of manganese sometimes deficient in the soil.—(*Scientific American Sept. 1937*).

PROTECTIVE WRAPPING FOR FRUIT

Protecting fruit on its way to market by wrapping in paper has long been practiced, and for years it has been thought proper to impregnate this wrapping with a material which will prevent spoilage by mold. Experiments have shown that iodine (*see page 271, May 1936, Scientific American*) is useful in this respect were it not for the fact that it may stain the fruit, diphenyl has been found much more satisfactory for oranges and grapes, which it keeps quite free from mold. The slight odor from diphenyl is not imparted to oranges or grapes, but even the trifling amounts of this compound necessary will injure bananas and apples. Benzoic acid and several essential oils, have little or no value as shown by experiments conducted in England.—(*Scientific American May 1937*).

VINEYARD PROTECTION

"An exchange says that artificial clouds were recently created for the protection of vines from frost at Pagny, on the Franco-German frontier. Liquid tar was ignited in tin boxes and pieces

of solid tar on the ground near the vines, Large clouds of smoke arose and protected the vines for two hours. Although vines in the neighborhood were injured by the frost, all that remained under the clouds were left uninjured.—(*Scientific American Aug. 1937*).

DOCTORED

Among the flavoring agents added to cigarettes are cocoa, chocolate, licorice, ginger, cinnamon, tonka, vanilla, coumarin, molasses, rum, brandy, maple, syrup, angelica, oil of anise, oil of juniper, oil of clovers, honey, sugar, and organic esters.—(*Scientific American May 1937*).

College Notes

SPORTS

Sports form an essential part of the College activities, We practiced all the three chief Sports, viz Hockey, Cricket and Football, but were not fortunate to have any victories to our credit. We could not stand in competition with the well trained teams of our opponents. We could not attain that standard as the very nature of our college work which occupies most of our day time, inhibits greater attention towards games.

We have in a way compensated for this, by scoring a decisive victory over all other teams in the volley ball tournament, conducted by the students of the Medical School, Nagpur. We were awarded a beautiful cup for the victory. Individual merit was also appreciated by the award of a championship cup and a medal to Mr. Maqsuddin, our netsman. Messrs R. N. Tewari, and P. C. Verma deserve special mention for their great display in all the encounters.

We are thankful to our Wardens Messrs B. S. Rao, and S. K. Misra, for the encouragement and assistance given by them from time to time.

THE COLLEGE TENNIS REPORT

Tennis of the college commenced its session, as usual, after the rains were practically over. In the beginning the strength of the Tennis Club was not much, the members playing on the court being those in the old roll and there being no new entry. But after the Divali vacation many new members were enrolled and in the month of December the two courts were seen to be over crowded.

The Secretary of club for the game of Tennis for this session was Mr. I. S. Dube of the 2nd year.

Mr. I. S. Dube and Mr. M. K. Das represented our college in the University Tennis matches.

The interclass Tennis tournament was held during the college gathering, and the entrants showed quite a good standard in the game.

The finals in singles and doubles were played on the gathering day before the honoured guests. Mr. H. N. Das and Mr. I. S. Dube played the match in singler. The match was very interesting as well contested. Mr. H. N. Das won the match and thus was declared Tennis Champion in singles for the session. He was awarded an silver cup by Mrs. Churchill.

The doubles finals were played after the singles the parties being Mr. H. N. Das and Deoras *vs.* M. K. Das and Mr. D. G. Dakshindas. Though Mr. Das had played a match in single and tired, yet he showed himself well up in the contest as well and won the match for his partner.

The most important feature of this session is the great interest taken by staff members who used to come and play with the students. This is a good sign and it is hoped that the club will improve very quickly and the standard of the game will be raised higher.

It was necessary, due to the increased number of members that the 3rd court should also have been opened but on account of want of funds this year, this aim could not be achieved.

Our special thanks are due to Mrs. Churchill for awarding the prize of Tennis Championship and thus creating enthusiam and competition among the players which helps enormously in the raising of the standard of the game.

DEBATING SOCIETY

Under the auspicies of the College Debating Society a meeting was held on 5th January 38, when Hon'ble Pandit Ravishankar Shukla, Minister for Education was in the chair. Rao Bahadur M. R. Ramaswamy Sivan, late Principal of Agricultural College, Coimbatore, delivered an interesting lecture on "Agricultural colonization" before a crowded audience of students and staff of the college. The learned lecturer in course of his speech referred to the Graduate Grant Chaks in Lyalpore District of the Punjab, which he had recently visited and quoted facts and figures as furnished byt he colonists in their successful attempt in farming.

Hon'ble R. S. Shukla thanked the lecturer and appealed to the educated youths to go to the villages and improve the lot of the poor villagers, in the province.

The next meeting of the Agricultural College Debating Society was held on 15th January 38 when Dr. E. F. Vestal M. Sc. Ph. D. of the Allahabad Agricultural Institute addressed the students on the subject of "Rural conditions in America as compared to those in India". The lecture was very interesting and impressive. The lecturer enlightened the students by describing in detail the activities of the American farmers and their organisation, which is the key-note to their success.

SOCIAL GATHERING

The Annual Social Gathering was held on the 22nd and 23rd of December. Opening of the gathering was with the Tennis finals. Mrs. Churchill as usual awarded a Tennis Champion cup to Mr. N. N. Das.

In the afternoon an elocution competition was held, Prof. Phatak's prize was awarded to P. R. Roday a student of the 4th year class for his able elocution. The Second prize was given to Mr. M. C. Gangrade of the third year.

In the evening a mucical entertainment was given by Mr. Kolarkar.

Next day "funny soprts" were held on the College Gymkhana ground. The sports mostly concerned Agriculture e. g. Bullock race and such others. The students showed great interest in the Sports.

In the afternoon the students were addressed by Colonel Kukde. His address was full of sound advice to the students of our college and was directly concerned with Agriculture. The honoured guest laid before us, his experiences of the different countries in the world which he had visited. After the address, prizes were distributed by Kukde to the following students.

4th year	(1) J. L. Sen.
	(2) A. B. Mitra.
	(3) S. S. Kuffalikar.
	(4) Shariful Hussain.
3rd year	(1) M. K. Reddy (Best all round student).
2nd year	(1) M. C. Gangrade (Best all round student.)
	(2) M. V. Gokhale (Mathemates & Agricultural Engineering.)
	(3) N. Y. Karkare (Practical Agriculture)
1st year	(1) G. R. Shirpurkar (Best all round student.)
	(2) B. W. Lakhe (Mathematies and Survey.)

The following students of the 2nd year won the prize for the ploughing competition held last year.

(1) I. S. Dube.
(2) N. B. Gupta.
(3) D. R. Yadava.

After the prize distribution the guests, staff members and students met on the lawns of the Research Institute for the "At Home", which was the last item of the Social Gathering programme.

EDUCATIONAL TOURS

This year as usual the 2nd year students had gone on an instructional tour to Betul. They learnt there about the production, and crushing of cane and making of gur. They were also shown the method of manufacture of sugar on a small scale by means of a centrifuge. Preparation of papain from papaya fruits was also shown to them.

The third year students were very fortunate to enjoy nearly 9 days tour. First of all they went to Powarkheda farm. This farm is situated between Itarsi and Hoshangabad and represents typical open field wheat cultivation of the Narmada valley. The students also got an opportunity of seeing the Powarkheda Agricultural A. V. M. School of which they had heard much. The school is one of finest of the type and imparts prevocational education in agriculture. The Headmaster and other teachers were kind enough to supply all the information demanded by our students.

The students of the school gave a demonstration of their drill and deshi-kasrat. Some students of the school showed their proficiency at 'double-bar. A programme of musical entertainment was arranged in which the students of our college also took part.

From Powarkheda the students left for Jubbulpore which represents the typical Haveli or bunded field method of wheat cultivation. On the first day the students saw the "Steam Tackle Plough" working in a field about 7 miles from Jubbulpore. In the after-noon they visited the "Perfect Pottery Works" and saw the cultivation of Potatoes in the Panagharh Village.

On the second day they visited the Military grass farm and the Military Dairy. They were able to see grass-farming on a large scale and the baling and stacking of grass. In the dairy they saw a typical bull of Holstein breed.

In the evening a short trip was arranged to see Bheraghat with all its beautiful scenery. At Bheraghat the river Narmada flows between the marble rocks and while boating the scene on both the sides is simply marvellous. There is also a beautiful water-fall.

On the third day the students visited the Richhai and Kheri farms. On the whole the stay at Jubbulpare was both interesting and instructive. Our worthy Principal accompanied the students at Jubbulpore.

From Jubbulpore they proceeded to Seoni farm and then to Chindwara. These represent the type of plateau cultivation. Of these the latter is a beautiful farm and has got almost all crops of C. P. and Berar. The students returned from the tour with greater experience and a feeling of freshness.

Crop Forecast

FOURTH FORECAST OF THE COTTON CROP OF THE CENTRAL PROVINCES AND BERAR FOR THE SEASON 1937-38.

Note.—On the average of the five years ending 1935-36, the area under cotton in the Central Provinces and Berar represented about 17·9 per cent of the total area under the crop in India.

The provincial area now stands at 4,046,701 acres which exceeds the actual area (3,951,645 acres) of last year by 2 per cent. It, however, falls short of the quinquennial and decennial averages by 4 and 12 per cent, respectively.

2. **Standard outturn 102 lbs. of cleaned cotton per acre.**—The percentages of outturns as estimated in the third forecast and as now reported by the deputy commissioners are given below :—

Estimated outturn in American notation.

District.		As reported in the third forecast.	As now reported.
Saugor	...	75	82.5
Jubbulpore	...	82·5	82·5
Hoshangabad	...	67·5	60
Nimar	...	86·2	75
Betul	...	75	75
Chhindwara	...	75·0	60
Wardha	...	78·7	67.5
Nagpur	...	75·0	67·5
Chanda	...	90	90
Bhandara	...	90	90
Drug	...	97·5	97·5
Raipur	...	112·5	112·5
Bilaspur	...	90	90
Akola	...	75·0	63·7
Amraoti	...	82·5	71·2
Buldana	...	67·5	60
Yeotmal	...	82·5	75

When the third forecast was issued, it was not possible to gauge exactly the effect of the unseasonable rain and hail at the end of October and also of the cold wave which passed over the province in the beginning of December. These, coupled with subsequent dry and cloudy weather, had an adverse effect on cotton plants and reduced the outturn of kapas as the formation of late buds and bolls was prevented in all the cotton districts. The number of pickings has consequently been less than was expected.

3. The provincial estimate now works out at 68·5 per cent of the normal or 725,700 bales as against the actual outturn of 78 per cent or 805,100 bales given in the season and crop report of last year. This year's outturn is therefore expected to be 9·5 per cent or 1·3 annas less than last year.

4. The number of carts of unginned cotton (kapas), which arrived in the markets of the Central Provinces and Berar from 1st September 1937 to 29th January 1938, was 471,446 as against 743,978 and 969,398 during the corresponding periods of 1936-37 and 1928-29, respectively. The total number of bales pressed according to the cotton press returns up to the 29th January 1938 was 297,881 bales as against 598,929 bales pressed at this time last year.

5. The prices of cotton (kapas) prevailing on the 31st January 1938 at certain district headquarters situated on the railway, *viz.*, Nimar, Wardha, Nagpur, Akola, Amraoti and Yeotmal range from 21 to 30 per cent lower than in the corresponding period of last year, the average price being Rs. 52-9-0 per khandi of 784 lbs. The table below compares the value of the estimated yield based on the prices ruling on the 31st January 1938 with the estimated value of the crop of last year on the corresponding date :—

District.		Value of the estimated yield for current year 1937-38. (in lakhs of Rs.)	Value of the estimated yield of previous year 1936-37. (in lakhs of Rs.)
Saugor	...	0·5	0·8
Jubbulpore	...	0·3	0·3
Hoshangabad	...	7·3	14·6
Nimar	...	58·8	83·8
Betul	...	2·5	3·5
Chhindwara	...	9·6	16·6
Wardha	...	43·2	61·1
Nagpur	...	33·8	44·5

Chanda	...	15·4	15·8
Bhandara	...	0·2	0·3
Drug Raipur Bilaspur	... ...	0·4	0·5
Akola	...	1,08·4	1,88·1
Amraoti	...	1,19·2	2,15·1
Buldana	...	71·2	1,22·6
Yeotmal	...	96·6	1,15·4
	Total...	5,67·4	8,83·0

The provincial area of 4,046,701 acres includes.

(a) Buri or American cotton	Acres.	(b) Verum cotton.	Acres.	(b) Verum cotton—concld.	Acres.
Nimar	... 26,100	Nimar	... 29,123	Raipur	... 2
		Hoshangabad	... 807	Akola	... 5,295
		Chhindwara	... 40	Amraoti	... 3,516
		Wardha	... 1,339	Buldana	... 20,513
		Nagpur	... 1,250	Yeotmal	... 7,964
		Chanda	... 150		

A SIMPLE METHOD OF EXTRACTING FIBRES FROM LINSEED STALKS.

BY R. H. RICHHARIA,

Oil Seeds Specialist, C. P.

(Oil Seed Research Station, Nagpur).

The Central Provinces and Berar is the chief Linseed growing province in India, occupying an area of nearly one million acres, the total production of seeds being about one half that of all India. But it is rather surprising that only a part of the linseed plant, the seeds, is utilized while the remaining huge vegetative part is a waste when it could be used as a source of useful fibre, from which various types of articles such as fine thread, cloth and strong ropes etc., can be prepared.

The fibres can be very easily taken out from the Linseed stalks by a simple method described below. It neither requires any machinery nor any trained or experienced man. It can, therefore, be practised without any difficulty by cultivators in villages.

(1) After harvesting the crop the stalks can be obtained for this purpose in two ways:

a. By the usual method of threshing the crop under the bullock feet and the stalks, devoid of capsules, could then be collected from the threshing floor. By his procedure a part of the stalk is generally broken.

b. By threshing the capsules only, with the help of a mallet, thus leaving the stalks unbroken.

(2) The stalks are then transferred for retting purpose into a fresh water tank or river or Nallah, where water is being gradually replaced (Fig. 1 shows a part of Nallah where the stalks are kept in water. Fig. 2 shows cemented tank, fitted with water pipe). They should be left in water for about seven to ten days. The right stage can be easily determined by pressing the stalk between the fingers. The fibres separate out easily on pressure if the right stage has been reached. Fig. 3 shows the fibres partially detached from the retted and dried stalks.

(3) The stalks are then taken out of water and spread uniformly on the ground for drying in the sun as shown in Fig. 2. This would normally take not more than two to three days.

(4) A handful of the material is then taken out at a time and beaten rather hardly in the begining and gently later on, with the help of a mallet weighing nearly two pounds, on a hard floor preferably stone. (Fig. 4 shows labourers at work in taking out fibres). During this process the fibres should be occasionally shaken strongly by lifting them up to remove the broken woody parts from the fibres. In Fig. 4 one of the labourers in the centre is seen doing this process.

The retted stalks can be preserved for a sufficiently long period after proper drying and fibres may be extracted at convenience.

A labourer after some experience can easily take ~~out~~ in a day (working hours being 8-9 hours) nearly six pounds of fibres. Our trials have shown that about fourteen pounds of retted stalks can yield nearly two pounds of fibres.

(5) The finished produce (See Fig. 5) can very well be utilised in village industry in various ways. It can replace Sun-Hemp fibre. Fine threads, cloth, strong ropes etc., can easily be prepared. Thus

linseed crop could now be grown for dual purpose, i. e. oil seed as well as fibre. Henceforward the farmer will be sure of getting at least the fibre of some quality if his crop is attacked by such a serious disease as Rust which so often occurs in many districts of this Province.

By this method about one million maunds of fibre can be produced in Central Provinces and Berar.

Thanks are due to the Imperial Council of Agricultural Research for financing the Scheme to conduct research on Oil Seed Crops of this Province.

FIG. 1.—Nallah where Linseed stalks are kept for retting.

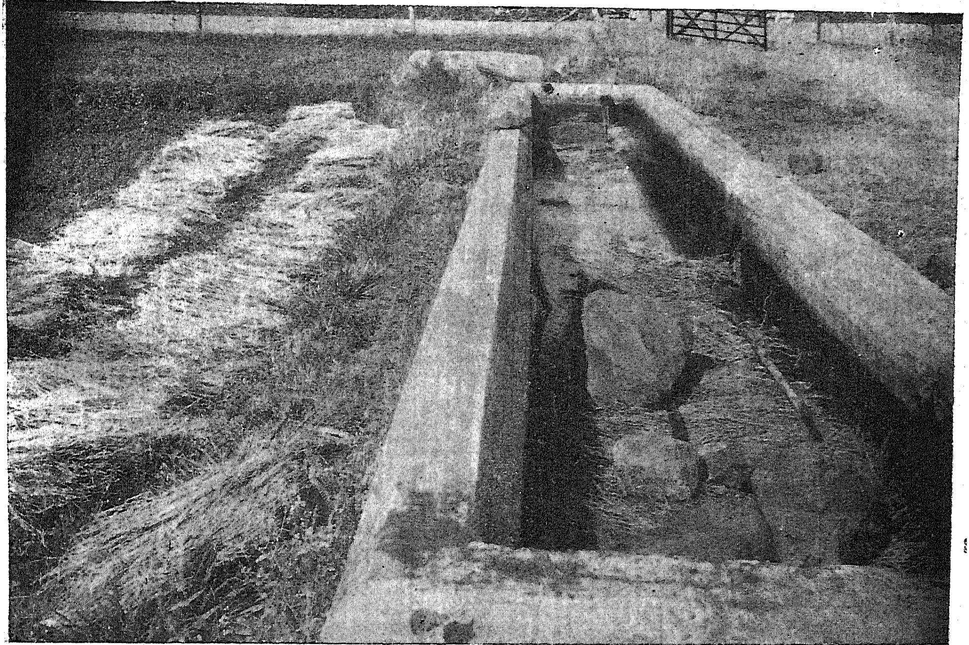

FIG. 2.—Cemented-tank with Linseed stalks kept for retting. (right).
Retted Linseed stalks kept for drying in the sun (left).

FIG. 3.—Retted Linseed stalks showing partially detached fibres.

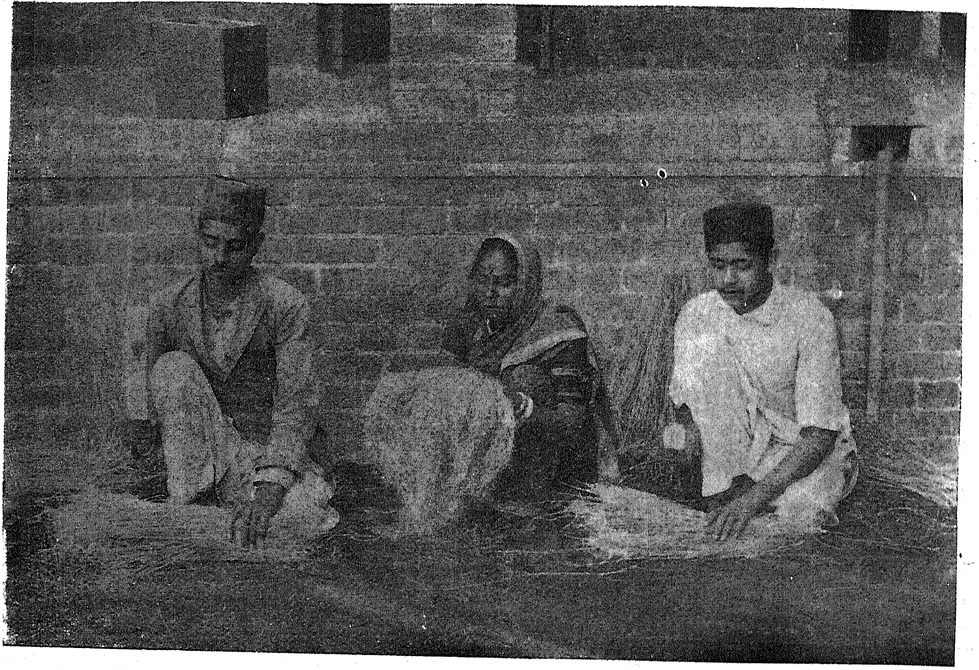

FIG. 4.—Labourers at work in extracting fibres from Linseed stalks by beating method.

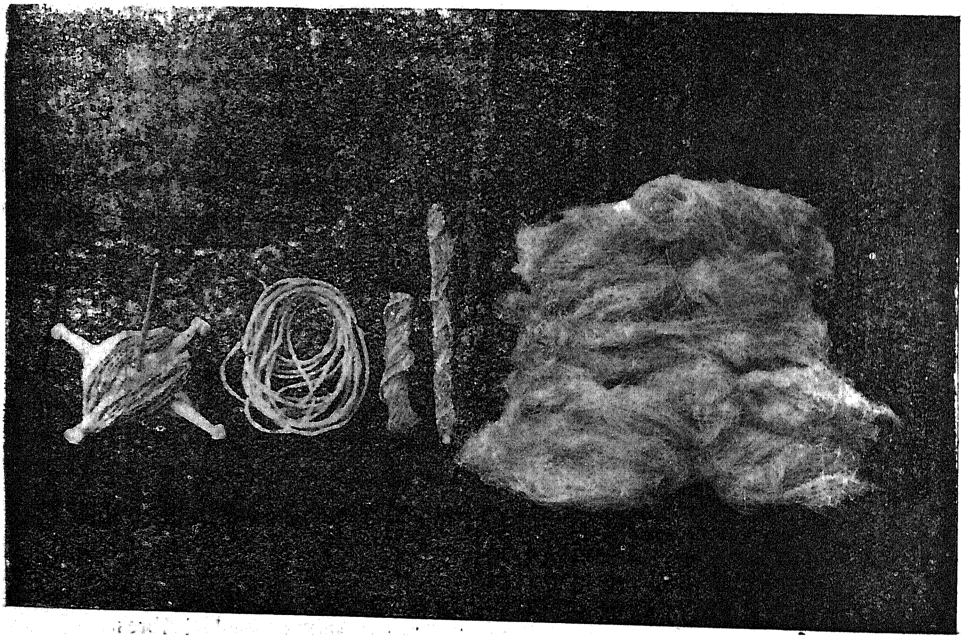

FIG. 5.—Finished fibre from Linseed stalks and ropes made from it.

Calender Of Operations

FLOWERS

By R. N. Sinha,

May :— The cold weather annuals will have finished now. Their seeds should be gathered, cleaned, dried and preserved in air-tight bottles or tins with labels for next year's use. Seeds like Aster, Pink, Phlox, Sweet-peas, Petunias, Candytuft, Nasturtium, Cornflower, Alyssum, Antirrhinum, Larkspur, Clarkia etc. do not deteriorate for two or three years.

When the seeds have been collected, the plants should be pulled out as soon as possible, and the beds dug out to a depth of about 2 feet, and the excavated soil left exposed to sun and air for about 2 or 3 weeks.

Afterwards well rotted cattle-dung manure in the proportion of two of soil and one of manure may be well mixed with the soil and returned to the pits. Horse dung, night-soil or town sweepings can also be added with advantage, of course in a well decayed form.

Potting soil for general use may be prepared in the following form and kept ready for use during the rains.

2. Parts soil ; silt preferable.
1. Part cattle dung.
1. Part leaf mould.
¼ Part sand in absence of silt.
⅛ Part charcoal dust.

Seed beds should be prepared and kept ready for sowing early in June. These beds should be about 4½ feet in width and 9″ higher than the ground level. The length may be according to requirements. A mixture of cattle dung and leaf mould manure in the proportion of half and half would make a suitable composition for seed beds. A layer of this about 1½" in thickness would be enough over the seed beds. Manures like horse-dung and poudrette should be avoided for seed beds as far as possible. It would be worth while soaking the seed beds 10 or 12 days before the actual date of sowing the seeds.

The following seeds may be orderd for the rainy season :—

1. Zinnia
2. Balsam
3. Cosmos
4. Sunflower, big,
5. Sunflower, small,
6. Celosia,
7. Gomphrena,
8. Melampodium.
9. Torenia
10. Hollyhock,
11. Marigold,
12. Cacalia,
13. Gillardia,
14. Calandula,
15. Datura,
16. Amaranthus.

Where hedges or borders are to be planted, a trench 1½ feet deep and 1½ feet broad may be dug and the soil exposed to the sun. If manure is available easily, it may be added in the proportion of 3 to 1. and the trench filled in and kept ready for sowing the seeds or inserting cuttings of hedges and borders.

The following varieties are suitable for hedges and borders :—

Hedges.

1. Haematoxylon
2. Ingadulcis
3. Dodonæa,
4. Duranta,

Borders.

1. Eupatorium,
2. Pedilanthus,
3. Pedilanthus variegata,
4. Justicia,
5. Alternanthera.

Surface drains should be cleaned and new ones dug, wherever necessary. Drainage is one of the important factors in plant life.

Caladium and Amaranthus bulbs should be removed from storage and made to sprout by about the middle of this month. Dahlia tubers should be potted in leaf mould for sprouting. Caladium and Hemanthus bulbs can be potted independently after separating the bulbs, the size of pot depending upon the size of the bulbs. Put a little fine sand round

about the bulbs while potting. Charcoal dust will be valuable in caladium soil for obtaining good colours.

June.—The seeds obtained in the last month for the rainy season may be sown in two lots, the first lot on or about the 6th and the second lot a week later. The seedlings will be fit for transplanting in about 2 to 3 weeks time.

Dahlia bulbs will be fit enough for separating by the 1st week. These may be potted in 6" and 8" pots.

Roses will have to be pruned and manured by about the 3rd week. Pruning need not be heavy in this season.

It is advisable to prune the ornamental and flowering shrubs also by the end of this month in order to keep them in shape and control, and to encourage their free flowering tendency.

This is the best time for sowing seeds or for planting cuttings of hedges and borders.

Cannas may be transplanted in this month. Violets and Geraniums in pots may be removed to some shady open verandah in order to protect them from the rains or otherwise they would be spoiled.

The rooted cuttings of Edward Rose may be potted in pots or planted in beds for budding in the next cold season.

July.—Any operations which could not be finished in the last month may be carried out in this month with safety.

This would be the proper time for re-potting potted plants.

Croton cuttings may be planted in a mixture, of coarse sand and leaf mould manure. In this month Dahlias will be getting ready for putting in big pots.

Hanging baskets may be renewed. Rockeries aslo should be renewed, or new ones planted. Whenever possible, the flower beds planted in the last month should be hoed or their soil loosened by a *khurpee.*

For obtaining good results, remove the first flowers of Zinnias, which are generally single ones. Remove the side shoots of Balsams, as flowers produced on the stem are always double, full, and more showy.

August.—Seeds for cold weather use may be orderd during this month. Any of the following seeds may be ordered according to one's choice. When the seeds have been received they should be kept in air-tight tins, bottles, or boxes till they are required for sowing :—

Gypsophilla.
Geyenimus.
Helichrysum (Everlasting flower).
Linum Grandiflorum (Flot).
Nasturtium.
Pansy.
Petunia.
Poppy.
Phlox.
Mignonette.
Salvia.
Sweet Pea.
Small sunfllower.
Aster,
Anterrihinum Snapdragon,
Alyssum.
Carnation.
Candytuft.
Cornflower.
Coreopsis.
Calandula,
Chrysanthemum Sagetum,
Datura,
Dianthus chinenics (Pinks).
Gillardia,

Seed beds as suggested in the month of May, may be prepared, manured and kept ready for sowing. The seed beds must be forked just a day or two before sowing seeds as the seed germinate better on freshly dug soil. At the time of sowing the condition of the seed bed soil should be moist.

In order to obtain good results from Sweet Peas, have the trench dug to a depth of about 1½ to 2 feet and after mixing in well rotted cattle dung manure in the excavated soil fill the trench and occasionally have the surface forked in order to keep back the weeds till sowing in October.

Planting of Croton cuttings, hedges, and borders may be carried out in this month also.

Whenever weather and time permit, do not fail to hoe the flower beds.

For obtaining early flowers aclimatized Aster and Salvia.Splendens seeds may be sown in boxes or pots, by the middle of this month.

If not already done, stake the Chrysanthemums and also do not fail to water them on open days. They should not be allowed to fag.

September.—First sowing of acclimatized seeds may be done in the first week of this month and second sowing of English seeds (imported) in the second and third weeks in instalments.

Seeds of tap rooted annua lssuch as Candytuft, Mignonette, Nasturtium, Alysseum may be sown in the last week of this month direct in the ground where they are to grow.

If possible, first and second sowings of all the seeds which require transplantation may be done in boxes or pots instead of beds, of particularly delicate seeds like Poppy, Petunia, Nicotinana.

Balsams will be coming to an end this month and they should be removed without delay. The seeds obtained from there are not of much use since acclimatized seeds produce only single flowers.

In order to obtain big blooms on Chrysanthemums disbudding and application of liquid manure should be started In this month.

Seedlings of Salvias and acclimatized Astors will be ready for planting. They may be transplanted in beds or potted in pots and transplanted in beds later on.

Operation of putting cuttings of different shrubs may be started in this month.

Budding of roses also can be started by the end of this month.

October.—Sowing of flower seeds, budding of roses, and planting of cuttings may be continued during this month.

The rainy weather annuals which may be finished up should be removed. If desired seeds may be collected from Cosmos, Cleomia, Celosia, Gamphrena, Melampodeum, Torenia, Sunflower and Amaranthus, but it is no good collecting Zinnia seeds. As a rule acclimatized Zinnia seeds produce mostly single flowers.

After preparing the beds any seedlings which may be ready from September sowing may be transplanted.

Sweet Peas, Candytuft, Mignonette, Alyssum may be sown direct in the ground where they are to grow. Sweet Pea seed would germinate better and earlier if soaked in water for about 12 hours before sowing.

Pruning of roses and flowering shrubs may be carried out in this month.

Violets may be re-potted.

November.—Larkspur seedlings which germinated late, may be ready for transplanting. This may be planted 10 to 15 inches apart according to the height of the variety and nature of the soil.

Candytuft, Allyssum, Mignonette etc. which were sown direct in the beds may be thinned out. The thining may be done in two instalments.

Sweet Peas will be growing vigorously. They should be staked before they start leaning towards the ground.

Chrysanthemums and Violets may be given liquid manure as often as possible. The principle in applying this manure should be "weak and often". Any gaps in the flower beds (failure in the seedlings transplanted last month) may be filled in as early as possible.

Regular watering and occasional hoeing are the important points to be observed in flower beds. Water should not be applied over the heads of young plants. It should be given to the roots from the sides or in between the plants before the Sun gets hot. Occasionally they may be sprayed overhead in the evening with a water-can having a fine rose.

Well rotten cattle dung manure may be applied and forked in the Canna beds, if possible. This will help them iu producing better flowers in December, January, February and March.

Roses will be in growing period. They should have proper attention towards watering and hoeing.

Chrysenthemums will need disbudding if bigger blooms are required

Operations of budding and putting cuttings may be continued.

December.—Croton cuttings put in during the rains will have developed sufficient roots by this time and may be transplanted singly in small pots.

Like Chrysanthemums, roses also need liquid manure and disbudding if bigger blooms are to be expected. Care should be taken in watering. Over—watering generally brings mildew on roses.

Coleus plants will be seen flowering. In order to preserve the vigour of the plants and colour of the leaves the flowers should always be nipped off as soon as they appear.

Roses which were budded in the previous months will need special attention in removing the side shoots of the stocks.

Budding and putting in cuttings of different varieties of shrubs may be continued.

In order to encourage branching of Sweet Peas the growing tips may be pinched off once when the plants are 9" to 1 ft. in height.

Roses will be blooming freely to the end of this month. The flowers may be cut freely whenever required for use." Cut and come back"- this is quite true in case of roses. In any case as soon as the flowers are over they should be removed.

January.—Carnations will start flowering. Attention should be paid to disbudding. Liquid manure may be applied to these with advantage.

Sweet Peas will be more or less in full bloom. To have plenty and long season of flowers see that early seed formation is not allowed. This also applies equally in case of all flowering plants, but more particularly in Sweet Peas, Carnation, Pansy etc.

Budding operation can be continued safely. Any failure of budding done in the previous months, may be rebudded now.

Regular watering and hoeing of all the flowering plants should not be neglected.

Chrysanthemums will be getting over. The main plants may be cut and removed. If necessary cuttings of these main stems may be prepared and planted in pots filled with fine sand or silt.

Sun-flower (small variety), Petunia, Coreopsis, and Portulacia seeds may be sown for obtaining flowers during summer season.

February.—Budding operation, if not already completed could be continued till about the third week of this month.

Chrysanthemum suckers will be getting ready for transplanting and they may be planted in small pots, 2 or 3 in each pots if early and big flowers are desired.

Flower seeds recommended in the last month of summer season may be sown in this month if not already done so. Cosmos seed would do well along with the other ones.

Dahlia bulbs may be removed from the pots and after drying them in shade for a day or two may be preserved in a pit containing fine clean sand.

Caladium bulbs could also be preserved with Dahlia bulbs or they may be allowed to remain in pots in a heap and covered with a good quantity of dry leaves.

This would be a proper time for putting Poinsettia cuttings.

March.—Seeds of the cold weather flower annuals will be getting ready and they should be collected, cleaned, well dried and kept in air tight tins or well corked bottles for next season's use.

Chrysanthemums left without repotting in the last month be taken up as early as possible.

Poinsettia cuttings if not already put in the last month may be put in now without much delay.

Hippeastrum lilies may be repotted or top-dressed. If they were repotted last year, top-dressing would do, as repotting of these every year is not desirable.

Flower seedlings ready for transplanting be transplanted as early as possible for use.

April.—Empty flower beds may be dug to a depth of about 1½ feet and the excavated soil left open to Sun for aeration.

Delicate plants such as Palms, Crotons, Aurelias, Draceanas, Clocos, Ferns etc, may be shifted to a partial shady place for protection from strong Sun and hot winds.

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Editorial Notes

With this issue The Nagpur Agricultural College Magazine will have completed the 12th year of its existence. Judging from the increase in the number of subscribers, particularly from outside this province, we are encouraged to believe that our efforts to make the magazine a useful organ for dissemination of information regarding various aspects of Agriculture are being appreciated by the public. We take this opportunity of thanking our subscribers for their patronage and express the hope that they will not only continue to extend the same in years to come, but also commend the magazine to others who are interested in Agriculture. We sincerely thank those who at great sacrifice of time have taken the trouble to enrich the magazine with their contributions.

CLOVES AND THE ZANZIBAR TROUBLE

They say that " what is one man's calamity is another man's opportunity." This is true of many things in life. Zanzibar cloves are boycotted in India at present. Attempts are, therefore, being made to produce cloves in India. Some enthusiasts have even approached us for details regarding the cultivation of cloves.

It may not be out of place to explain why Zanzibar cloves are boycotted in India. The Zanzibar Government introduced,

during the middle of last year certain legislations presumably in the interests of the clove trade in general and also the local people who are engaged in that trade. This seems to have placed at great disadvantage the Indian settlers, numbering 1,50,000 to whose enterprise, initiative and financial risks incurred, the Zanzibar clove trade owed its recent supremacy. Zanzibar Indians as a protest against these legislations suspended their activities there and appealed to people in India to boycott the Zanzibar cloves which was imported into India. In sympathy with their countrymen in Zanzibar, Indians have boycotted Zanzibar cloves. As a result of this feeling in India against Zanzibar cloves, the Zanzibar Government has suffered a loss of Rs. 4,50,000/- in her revenue during the last twelve months. It is recently reported that in order to pacify the Indian settlers, the Zanzibar Government has contemplated certain amendments in the legislation which were resented to by the Indian settlers in Zanzibar. Let us hope that fair treatment will be accorded to our brethren in Zanzibar. In the meanwhile, the following short note on the cultivation and curing of cloves will, we are sure, be useful to those who are interested in this commodity, which has been the cause of trouble in Zanzibar.

Cloves are the dried unexpanded flower buds of the Clove Tree, Caryophyllus Aromaticus, belonging to the natural Order Myrtaceæ. The corolla forms a ball on the top between the four teeth of the calyx and the stalk is the immature ovary. They are first green, then turn yellow and finally bright pink or scarlet. In this last stage, they are ready to be picked. If not picked then the flowers expand, become fertilised and the stalk of the clove, develops into a succulent purple coloured berry. This is known technically as " Mother-clove."

The clove tree is chiefly grown in many parts of the East Indies and islands of the Indian Ocean. It has also been introduced into the West Indies. But four-fifths of the world's supply comes from Zanzibar and the neighbouring island of

Pemba. Forty per cent of cloves imported into India (10 per cent of cloves produced in Zanzibar) comes from Zanzibar. The word clove is derived from clavus, (a nail) on account of the clove resembling a nail. Charaka, the ancient Indian Medical writer refers to cloves.

For raising clove plants, fresh ripe berries (which contain one or two seeds) known as "Mother-cloves" are sown in rich mould about 12 inches apart. Seeds loose their vitality if the berries dry. They germinate within 5 weeks. When the plants are about 4 feet high, they are transplanted 20-30 feet apart. The plant can also be raised by layering. Young branches laid across the ground strike root in about 6 weeks. The land chosen should be well drained and rich in organic matter. Clayey and marshy soils are not suited. It seems to have a partiality for volcanic soils even in Malaya. The trees do not like direct sea breeze, hot sun, and high winds. They are best grown in valleys. Plants begin to bear when they are 6 years old and are in full bearing by the 12th year. After 20 or 25 years, they are too old to be profitably preserved though they may yield up to 150 years. The yield obtained per tree is about 6 to 7 lbs. of dry cloves. The clusters of flower buds are either hand picked or beaten with sticks and collected on cloth. They are either dried entirely in the sun or sometimes they are partially dried by being smoked over a shallow wood fire and then the drying completed in the sun. Occasionally, the buds are scalded in hot water before being dried. The flower buds loose 60 per cent weight in drying.

The clove is one of the most important of spices and an important flavouring agent. The oil of cloves, obtained by distillation of the clove, is used in perfumery. The value of clove oil depends on the percentage of Eugenol contained which varies from 76 to 85 per cent.

Original Articles

CULTIVATION OF POTATO IN THE VILLAGE-UPLIFT AREA OF PIPARIA CIRCLE, IN THE SOHAGPUR TAHSIL OF HOSHANGABAD DISTRICT.

By M. S. Barker,

(Extra Assistant Director of Agriculture, Hoshangabad.)

Introduction.—Potatoes are cultivated almost in all parts of India both as kharif and rabi crops. It is, however, found that the potato crop flourishes well at places, having an altitude between 1500 and 3500 feet above sea level. In this province it is mostly grown as a rabi crop. Chhindwara, Saugor and Pachmarhi are better suited for its cultivation, being situated at a higher altitude and enjoying a cooler climate than other parts of the province. It cannot be grown successfully in hard and sticky soils and where the climate is hot.

In the village uplift area of Piparia circle the crop is introduced since the last seven years. There was a small area before this and the cultivation gradually increased and now it is grown in 90 acres. There is still great scope for increasing the area but for want of irrigation facilities the cultivation is handicapped. If cultivators can find more money to dig wells the area can be expanded. In the present depression the condition of the cultivators has gone down much and to improve its, crops like potatoes, vegetables and fruit are necessary. Potato is used as a vegetable and due to its keeping quality it is available for the whole year round.

Soils.—Light sandy soils, Sehra, Domatta and Kachhar are generally preferred for potato cultivation. Heavy sticky soils get water-logged and hence they are avoided. Such soils get hardened when dry and hence the potato does not develop well in them. On no account should nagarmotha-infested fields be chosen for potato growing as the germination is defective in them. In Sohagpur Tahsil the soil of Rampura Village situated at a distance of four miles from Piparia is best suited for potato cultivation.

Cultivation.—One bakhering is given in hot weather, followed by two ploughings in the rainy season, bakhering also being given after every ploughing and during breaks. At the close of the monsoon again, ploughing is done and the land is exposed to heat and sun till the rabi sowings are over. After rabi operations are over the cultivator ploughs his land again and bakhers. If any clods are left, they are broken either by working a planker or by hand by means of kudali. The land thus gets ready by the end of October, having fine tilth to a depth of 7" to 9"

Some cultivators use sann as a green manure, which is generally ploughed in August and necessary cultivation is given afterwards, when the sann crop gets rotted. Hot weather ploughing practiced at Silari farm in March has been found to give good results The soil is exposed to the heat of the sun for the whole of the hot weather and thus more plant food is prepared in the soil. Some cultivators have begun to follow this method.

For planting furrows are prepared by spade at a distance of 15" to 18" apart. The distance varies according to the richness of the soil and quantity of manure applied. Cross channels and beds are then prepared. This practice is generally followed by the cultivators and it is costly as 8 to 10 men are required for one acre. The cheapest process adopted at Silari Farm, for making furrows, is to fix a wooden piece between the share and the beam of the plough. It is then worked and with one pair of bullocks, furrows and ridges are prepared in half a day in one acre. This method is being demonstrated and some cultivators have begun to adopt it. Delta plough is the best of all for making furrows as it is adjustable to different widths and depths. This plough is being introduced.

Manuring.—After the beds are prepared small pits are dug at 6" to 8" apart in furrows and are filled in with a small quantity of well rotted cattle dung manure. This is the general practice followed by the cultivators with a view to make economy in manure as only 8 to 10 cart loads are required. Some, however, apply Farm Yard Manure at the rate of 30 cartloads per acre, in the hot weather after ploughing and also fill in the pits with manure at the time of planting. All other manures containing potash are useful. Some cultivators apply ashes of til plants also with good results.

Seed.—There are many varieties of potatoes but in these provinces, generally Nainital, Italian, Patna, Farkhabad and Simla varieties are used for seed.

Potatoes grown locally do not keep till the sowing season, because of the hot climate and hence they have to be imported. The seed-potato crop is allowed to remain one month longer in the field before it is harvested. This helps in keeping the seed for a longer time. After the harvest, the potatoes are spread for 2 months on shelves, having a thin layer of sand, during which time the eye-buds develop, which help in proper germination.

In the Piparia tract, local merchants used to order seed from outside and sell it to the growers at an exorbitant rate. Since the last three years, the Tahsil Agricultural Association, Sohagpur, imports the seed from Simla and supplies it at a cheaper rate, on cash as well as credit to growers. Due to this facility, the area is on the increase. Middle size tubers are used for seed. They are cut in sets, keeping two to three eyes in each. Small potatoes are planted whole. It is found that cut sets, give more outturn than whole tubers. The seed rate varies from 10 to 12 maunds per acre. At the time of harvest potatoes are sold at Rs. 2/- to 2/8/- per maund, while at the time of planting the rate goes to Rs. 5/. to 6/- per maund. Thus for every acre seed of the value of Rs. 50/- to 60/- is required. It is this cost which prohibits some growers from taking up its cultivation in the present depression.

Planting is done generally in November, but it continues some times into December. It has been stated above that small pits are dug in furrows which are filled in by well rotted cattle dung. The sets are planted in the pits at a distance of 6" to 8" apart. At the time of cutting sets, ash is applied on the cut part, so that the sets may not rot and insects may not attack them. The planted sets are covered with about an inch of earth. Two to three waterings are given in the beginning to avoid rotting and to ensure satisfactory germination. After the third irrigation watering is done every eighth day. About 14 waterings are required in all. Weeding is done when the crop is about 4" high. At this time, potato fertilizer mixture is also applied by some cultivators. Earthing is done by hand when the crop is 7" to 8" high.

Diseases and other factors responsible for the loss in growing potato crop.—This crop is susceptible to frost. Copious irrigation and burning of dry weeds round about the crop, help to save it to some extent.

Parra.—Parra disease in which curling of the leaves takes place is due to insufficient moisture in the soil and is generally found on lighter soils receiving less irrigation. Timely irrigation is useful as a preventative. Light poor soils, should not be selected for potato cultivation, as in such soils Parra disease is more frequent.

Gonchi or Sambhar Illi.—This is a caterpillar which harbours in the soil near the stem of the plant. It cuts the growing branches and thus reduces the outturn. Whenever cut branches are seen one knows that the caterpillar is present. By stirring the soil and searching near the cut branch to a depth of 1" to 2" the catterpillar can be found. It should be

picked up and destroyed, either direct or by immersion in Kerosene oil water solution kept in a small earthen pot. The picking of the caterpillars is best done in the morning before 8 a.m. as they can then be readily found.

The crop ripens in 3 to 3½ months from the time of planting. The average outturn is 105 maunds per acre but in those fields which get full doze of manure and fertilizer, it gives 150 maunds per acre.

In Sohagpur Tahsil the soil of Rampura village, situated at a distance of four miles from Piparia is best suited for potato cultivation.

In this Tahsil there is no arrangement for long term storage. If some suitable method of storage is found, the cultivators will be benefitted much as at the harvest time the rate is very cheap, while from June the rate increases to something like 2½ times.

The following are the details of expenditure and receipts in the cultivators' field:—

RECEIPTS.				EXPENDITURE.			
					Rs.	A.	P.
Value of 105 Mds. potatoes at Rs. 2/2/- per Md. per acre.	223	2	0	Cultivation charges	14	0	0
				30 cartloads of manure and its spreading	17	0	0
				12 Mds. seed	63	0	0
				Planting and making sets	4	0	0
				Weeding	3	0	0
				Earthing	5	0	0
				14 irrigations	42	0	0
				Digging of potatoes	5	0	0
				Watching	8	0	0
				Land Revenue	1	0	0
				Marketing	4	0	0
					166	0	0
				Net profit	57	2	0
Total	223	2	0	Total	223	2	0

RECEIPTS.	Rs.	A.	P.	EXPENDITURE.	Rs.	A.	P.
Outturn per acre, 150 Mds. at Rs. 2/2/- per Md. (when full application of manure with cattle dung or poudrette[1] or potato mixture as top dressing is given)	318	12	0	Cost of cultivation etc. as above	166	0	0
				Extra cost for digging and making potato mixture	2	8	0
				Marketing	2	0	0
				5 Mds. potato mixture	33	0	0
				Cattle dung 30 cart loads more	17	0	0
					220	8	0
				Net profit	98	4	0
Total	318	12	0	Total	318	12	0

IMPORTANCE OF SYNTHETIC FARM YARD MANURE IN VILLAGES, WITH SPECIAL REFERENCE TO VILLAGE KOTGAON, TAHSIL AND DISTRICT HOSHANGABAD.

By D. P. Persai.

Introduction.—It is not an uncommon remark to hear from everybody interested in Indian Agriculture that Indian soils are getting poorer every day and consequently produce low outturn of crops. One of the most important of all reasons which can be safely attributed for the poverty of the soil, is the inadequacy of the most commonly used Farm Yard Manure in villages. Workers in this field have suggested that the deficiency may be made up by fertilizers. Another idea is also suggested and it is the supplementing of Farm Yard Manure with synthesised manure from weeds, rubbish leaves of trees etc. This manure after analysis has been found to be of the same quality as Farm Yard Maure and hence it has been given the name of "Synthetic Farm Yard Manure". This investigation is meant to find out how far the hypothesis of supplementing Farm Yard Manure with Synthetic Farm Yard Manure is correct and to what extent it can benefit the cultivators.

The village.—The village chosen for investigation is "Kotgaon" in Hoshangabad Tahsil and District. It lies in the valley of "Satpura" mountain and has 5 types of soil, (Viz), Kaber Doyam, Domatta Avval, Domatta Doyam, Sihar Avval and Sihar Doyam. The population of the village is 812 and it has an area of 969.41 acres. Out of this, 702.97 acres is the area cultivated. The climate of the village is typical of the

Indian plains, with moderate cold in the cold weather and intense dry heat during summer. The number of families in the village is 174 Their main occupation is cultivation of land. The average rainfall of the village is 43.56 inches.

Amount of Farm Yard Manure produced in the village.—The Bulk of Farm Yard Manure produced in the village is made up of. (a) Cattle dung. (b) Kachara (Sweepings of the cattle yard.)

(a) **Cattle dung.**—Cattle population, making up for the total bulk of dung produced is 490. Out of this, 201 are bullocks, 116 cows, 44 he-calves. 68 she-calves 31 buffaloes, 11 buffalo male calves and 19 buffalo female calves.

For manure, cattle dung got is of rainy season only. That produced during hot and cold seasons is utilized for making dung cakes (Kandas) to be used as fuel. To calculate the amount of cattle dung got for manure during rainy season, an experiment was arranged to estimate the amount of Gober given per day by each species of cattle and from these figures, amount of cattle dung per rainy season has been calculated.

Quantity of fresh dung voided per day by individuals of different kinds of stock are Buffalo 22 lbs, Bullock 12 lbs, Cow 9 lbs, he-calf 7 lbs, she-calf 6 lbs, Buffalo male calf 4 lbs. and Buffalo female calf 3 lbs.

Therefore, the amount of cattle dung produced during rainy season which consists of 120 days is 265 tons. Manure produced out of each ton of cattle dung is 2/3rd ton and hence 177 tons of manure is got out of 265 tons of cattle dung.

(b) **Kachara.**—Kachara of all seasons, i.e., hot, rainy and cold, is utilized for manure making. This Kachara is the remnant of coarse grass, kadbi, Bhusa etc., fed to the cattle. By actually weighing on certain days the Kachara obtained it has been estimated that 421 tons are obtained annually.

The following table shows the amount of total manure produced in the village at present.

No.	Material for manure.	Amount of material.	Amount of manure produced.	Remarks.
1	Gober (Animal dung).	265 Tons.	177 Tons.	Only of 4 months.
2	Kachara (Cattle shed sweepings).	421 Tons.	842 Tons.	Of 12 months.
		686 Tons.	1,019 Tons.	

Deficiency of Manure.—Manure's share is large for the successful production of crops. Since no figures are available of the rates at which the manures should be applied to different crops of the village, the figures of the Government Experimental Farms of this Province will act as a guide with sufficient accuracy. The rates of manure to different crops and amount of manure required by the village when applied at the said rates, to different crops is shown in the following table.

Name of the crop.	Area in acres.	Farm Yard Manure applied in tons per acre.	Total manure in tons.
		KHARIF	
Paddy	124.16	4	496.72
Kodon and Kutki	126.71	2	253.42
Juar	177.71	3	533.13
Tur (Double cropping)	397.17	...	...
Garden	4.00	...	...
Miscellaneous	40.26	6	255.5
		RABI	
Wheat	98.76	4	395.4
Grain	101.10	...	...
Linseed	11.38	...	...
Garden	5.00	6 Tons.	30
			1,964.17

From the study of the above two tables, it is evident that manure needed for a "Rational and Judicious" system of manuring to obtain high outturn of crops is 1,964.17 tons but the manure produced at present is only 1,019.0 tons. Therefore, there is a deficiency of 945.17 tons; if it is granted that all 1,019 tons produced is used for manuring the land.

But in village Kotgaon there is a special difficulty (encountered by all villages situated on the banks of river in which summer crops like melons, vegetables etc., are sown in the river beds.) in using the total amount of manure produced for manuring the lands. The cultivator being always hard-pressed for money sells his manure to the melon growers instead of applying it to his land. By applying, to the land, he gets indirect profit and that too after waiting, but he gets in cash from these melon growers and therefore, he prefers this mode of disposal of his little amount of manure. Thus, nearly 500 tons out of 1,019 tons produced are used for a heavy dressing to melon crop in the bed of river "Tawa" during summer. So only 519 tons of manure are left for the

crops of the village. This increases the deficiency from 945.17 to 1,445.17 tons in this village.

How to make good the deficiency.—There are two sources of making good the deficiency in manure in the village. (a) By Synthetic Farm Yard Manure. (b) By utilizing more dung for turning into manure.

(a) Synthetic Farm Yard Manure. (S. F. Y. M.)—Recommendation of fertilizers to supplement the deficiency of Farm Yard Manure is out of question, as they are too costly and require more skill for their application. Besides this, they lack in organic matter which is very badly needed by Indian soils. Therefore, S. F. Y. M. obtained from the waste products of leaves of trees, rubbish of the village, weeds etc., could be more profitably used. There are many points in favour of recommending this source of manure. e g., (i) Besides giving manure, the village will be cleared off the weeds and rubbish automatically. (ii) It gives a value to the bye-products of crops. e. g. stalk of tur, til etc. (iii) The process of making it is very simple, cheap and within the proper understanding of village folk. (iv) Synthetic Farm Yard Manure has been found on analysis to be equally valuable in supplying plant food as F. Y. M. This fact is illustrated from the following table:—

Sample of the manure.	Percentage of moisture in the sample.	Percentage of chemical substances in dry matter.	Percentage of 'N' in dry substances.	Percentage of 'N' in total chemical substances.
Cotton stalk S. F. Y. M.	11.77	51.60	1.60	3 38
Paddy straw S. F. Y. M.	45.60	23.60	1.09	4.63
Leaves and weeds S. F. Y. M.	51.66	33.60	1.22	3.67
Juar stalk S. F. Y. M.	27.10	18.35	0 52	2.81
Cattle dung Manure No. 1	26.50	34.70	1.24	3.57
Cattle dung Manure No. 2	45.50	25.32	1.03	4.04

Note.—In the above analysis, Juar stalks were not fully rotted.

Amount of S. F. Y. Manure available.—A survey of the material to be used in S. F. Y. Manure in villages, reveals that the following four materials are most common. (i) Stalks of crops e. g. Tur, Cotton, Til etc.

(ii) Leaves of trees, e. g. Mango, Bamboo, Mahua etc. (iii) House sweepings. (iv) Weeds of Kharif crop and weeds in and around villages e. g. Tarota.

According to locality, there can be many more additions in the presented list. The following table shows the names and quantity of materials availabe for S. F. Y. Manure in village Kotgaon.

Name of the material.	Quantity of the material	Tonnage of manure.	Remarks.
	Tons.	Tons.	
House-hold sweepings	170	340	Found by experiment that a family gives 6 lbs per day.
Weeds from kharif fields	32	32	@ 150 lbs per acre of kharif crop which are weeded.
Kharif stubbles	25	50	Juar stubbles @ 200 lbs per acre. Paddy stubbles @ 160 lbs per acre.
Tarota (cassia Torao and other weeds.	22	22	44 acres waste land grows weeds. Thus @ ½ ton per acre.
Leaves	13	26	Mango trees 455 @ 60 lbs per tree. 28 Mahua tree @ 50 lbs per acre.
Tur stalks	182	374	Tur area is 395 acres.
Til stalk	40	80	80 Acres under Til (Double cropping) @ ½ ton per acre.
Sweepings of the threshing floor.	35	70	@ one maund per acre of whole.
Total ..	519 Tons.	954 Tons.	

b. Utilizing more cattle dung for turning into manure.—As already stated at present cattle dung only of rainy season is used for turning into manure. Cold and summer seasons' cattle dung is turned into cake. There is possibility of saving more cattle dung from cold and summer seasons after giving due allowance to all its other uses. Cattle dung is also used for cleaning the houses and threshing floors, for fuel for retyring the cart wheels, for making mud walls etc. After giving a legitimate share to all these items and cake making, the probable saving in Gober is to be

worked out. For this the total amount of cattle dung produced annually has to be found out. It is a very complicated problem to find out the amount of dung produced by the whole village annually for it varies according to the feed of the animals and climatic conditions. The feed in the villages changes with the season. The usual practice followed in summer is to leave the cattle to help themselves on dry leaves and remnants of crops of Rabi, or Kharif season. The amount of cattle dung got during this season dwindles down naturally. During cold season the maximum amount of dung is got as it provides abundance of green grass. During rainy season, fairly good amount of dung is obtained but it contains more amount of water.

I arranged experiments with different species of cattle in all the three seasons without interfering with their daily routine. No artificiality was created by tying them during day and feeding lavishly against the usual practice. Accordingly record was taken for 5 days during summer starting from 28-4-36 to 2-5-36, for 3 days in rainy season i. e., from 1-8-36 to 3-8-36 and 3 days in winter i. e., from 29-12-36 to 31-12-36., and from figures based on these records the table drawn up below shows the total dung obtained during 1935-36.

Table showing total dung produced in the year 1935-36 in village Kotgaon.

No.	Species.	Average dung per animal during			Average.	Total heads in the species.	Total dung per day of species.
		Summer season.	Rainy season.	Cold season.			
		lbs.	lbs.	lbs.	lbs.		lbs.
1	Buffalo	16	22	28.3	22.1	31	685.1
2	Bullock	9	12	15	12 0	201	2,412.0
3	Cow	6	9	12	9.0	115	1,035.0
4	Cow he-calf	5	7	9	7.0	44	308.0
5	Cow she-calf	4	6	8	6.0	67	402.0
6	Buffalo male calf	2	4	7.3	4.1	11	45.1
7	Buffalo female calf	1	3	4	2.7	19	51.3
							4,918.5

Dung produced per day=4,918.5 lbs.

∴ Annually =17,95, 652.5 lbs.=801 Tons nearly.

The main item in which cattledung is spent in the village is in making cakes for fuel. An experiment was arranged to find out the exact quantity of Gober required for turning into cakes and consequently for fuel. The fuel of the village consists of wood and dried dung. I allowed the cook to take the fuel for daily use, by rough measurement with a basket or anything like it. I weighed this quantity in the morning and then reweighed next morning, to see if there was any surplus. By maintaining proper records of wood and dung cakes used by the families as fuel, I have been able to estimate that 137 tons of wood and 64 tons of dung cakes were used in the village during 1935-36 as fuel.

The ratio of fresh dung to dried cake is 2 : 1 and therefore 64 tons of cake will require 128 tons of cattle dung. In addition to this, the dung is used for other miscellaneous purposes also e. g., cleaning the floors of houses, for threshing floor, retyring the cart wheels etc. The exact amount in these various operations is known but for purposes of calculation 76 tons is taken as round figure. Thus, only 559 tons of cattle dung are left out of 801 tons for turning into manure. This figure adds 314 tons of cattle dung to the original amount of 265 tons available at present for turning into manure. (See table on Page 187).

Table showing total amount of manure from all sources.

No.	Name of the source.	Tonnage of the material.	Tonnage of manure produced.	Remarks.
1	Cattle dung	559 tons.	373 tons.	Mauure is $\frac{2}{3}$rd of the dung.
2	Cattle shed sweepings	421 tons.	842 tons.	Manure is two times the material.
3	Synthetic Farm Yard Manure	519 tons.	954 tons.	For details see table on pages 190.
		1,499 tons	2,169 tons	

Manure required for following a rational and judicious system of manuring is 1964,17 tons and 1,019 tons are produced at present. The deficit is 964.17 tons which is nearly made good by 954 tons of Synthetic Farm Yard Manure. But this village spends nearly 500 tons in Melon cultivation in the river bed of "Tawa" and this demand ought to be met. The manure expected from all sources is 2,169 tons and therefore

nearly 205 tons is the saving, affected after deducting 1,964.17 tons for manuring the land. 205 tons may be spared for melon cultivation or if 500 tons is applied, some crop may be manured in alternate years or this small amount of manure may be purchased.

Comparison of—*(a) Present system of Manuring (b) Rational and Judicious System of Manuring as regards their effect on the financial position of the village.*

To study the financial position of the village under these two methods of manuring; the income and expenditure of both will have to be estimated—Income of the village consists of:—(a) Agricultural Income (Mainly) (b) Income from side occupation.

The following table shows the income from Agricultural Produce under present system of manuring.

Name of Crop.	Area in Acres.	Normal outturn since 1884 to 1935 per acre.	Total outturn in normal years.	Sale rate per Rupee in the local Market.	Total Value.
		lbs.	lbs.	lbs.	Rs.
Paddy	124.18	850	1,05,570	45	2346/-
Konda and Kutki	126.71	520	65,936	50	1318/8/-
Juar	177.71	600	1,06,620	42	2538/8/-
Tur	379.17	500	1,98,585	25	7943/-
Garden	4.00	Rs. 30/-	Rs. 112/-	...	112/-
Miscellaneous	40.26	Rs. 35/-	Rs. 1,410/-	...	1410/-
		RABI			
Wheat	9.87	600	59,280	30	1976/-
Grain	101.10	530	53,530	35	1529/-
Linseed	11.38.	180	2,052	20	102/-
Garden	5.00	Rs. 35/-	Rs. 175/-	...	175/-

Total Income=Rs. 19,450/.

The following table shows the income from Side Occupation.

No.	Source of income.	Value of the income.
1	Ghee making.	900 0 0
2	Work in the Tile Factory at Bagra.	700 0 0
3	Carting of Muram, Githee, timber etc.	750 0 0
4	Forest work i. e., cutting of timber.	1,350 0 0
5	Variable labour employed out side.	375 0 0
6	Income by the sale of manure to water melon cultivation.	500 0 0
7	Income from water melon crop.	1,000 0 0
		Total 5,575 0 0

Therefore Total Income of the village :—

Agricultural Income from produce =19,450 0 0

Extra Income ... = 5,575 0 0

Total. Rs. 25,025 0 0

Table showing monthly expenditure of a cultivator in the village.

No.	Item of Expenditure.	Cost.
1	Food ...	3 8 0
2	Clothing ...	0 12 0
3	Light ...	0 6 0
4	Rent ...	0 2 0
5	Education ...	0 4 0
6	Festivals ...	3 8 0
		Total Rs. 5 8 0

There are 812 people in the whole village but this number includes people of all ages, e. g., child, adult and old. For every 100 people of heterogeneous age, 77 people are taken as adults. Therefore the number of full grown people in the village is 625. The total annual expenditure of the village amounts to 625 x 5/8/- x 12 or Rs. 41, 340/-

Table showing balance sheet of the village Kotgaon in 1935-36

System of manuring.	Total income.	Total expenditure.	Profits or loss.	Remarks.
	Rs.	Rs.	Rs.	
Present system of manuring. ...	25,025	41,340	16,316	This loss is made good by loan.

The income from "Rational and Judicious System" of Manuring is higher than the present system. The income from side occupation is constant and so also the expenditure of the village.

The following table shows the income from "Rational and Judicious System of manuring."

Name of the crop.	Area in acres.	Outturn per acre.	Total outturn.	Sale rate in local market.	Total value of crop.	Remarks.
		lbs.	lbs.	lbs.	Rs.	
			KHARIF			
Paddy	124.18	1,600	198720	45	4,415	
Kondon and Kutki.	126.71	1,000	126710	50	2,520	
Juar	177.71	700	124397	42	2,863	
Tur	397.17	700	278019	25	11,120	Due to residual effect.
Garden	4.0	Rs. 50/-	Rs. 200/-	...	200	
Miscellaneous	40.26	Rs. 60/-	Rs.2415/-	...	2,415	
			RABI			
Wheat	98.76	800	79008	34	2,601	
Grain	101.10	650	65650	35	1,871	"
Linseed	11.38	250	2845	20	143	
Garden	5.0	Rs. 70/-	Rs. 350/-	...	350	

Total Rs.... 28,598/-

The following table shows the Balance Sheet of the village under "Rational and Judicious system" of manuring.

Income from		Total.	Expenditure.	Profit or loss.
Agricultural produce.	Side income.			
Rs. 28,598	Rs. 5,575	Rs. 34,173	Rs. 41,340	Rs. 7,167 Loss.

Importance of S. F. Y. Manure.—From a study of the two balance sheets it is quite evident that the latter system i. e., "Rational and Judicious System" of manuring is more suitable to the village. The village incurs a loss of Rs. 16,315/- under the former system while the loss is reduced to Rs. 7,167/- in the latter. Thus, there is a distinct saving of Rs. 9,148/- in the latter (Rational and Judicious System) system over the former. This saving is chiefly effected by making good the deficiency of manure by Synthetic Farm Yard Manure; to follow the "Rational and Judicious System" of manuring.

Process of making S. F. Y. Manure.—It will not be out of place to mention here briefly the process of making Synthetic Farm Yard Manure. If the process it not simple and practicable; it would be difficult to adopt. One simple process is as follows :—

Pits 10' square and 6" deep are dug before the rains. Into them trash of non-woody description e. g., old bhusa, cane megass, old leaves, weeds etc., may be thrown. Woody stalks like cotton and tur may be first broken into pieces by constantly passing over of carts and then pitted.

This trash should be spread and levelled in layers 1' thick and over each layer ought to be spread a thin layer of cattle dung. Water should then be poured liberally. Instead of "cattle dung" water may be sprinkled. The proportion of dung to water is 1:25. Thus, a 4' high heap may be made and covered by earth. Generally the trash rots during rainy season, but if it fails to rot, water should be sprinkled occasionally over the pit to keep it moist and to help the action of aerobic bacteria. After complete rotting the material may be taken out and applied to the fields.

There are other more modern methods of producing very rapid results such as instead of dung water, a mixture of Bone-meal and Sulphate of Ammonia, may be used to rot the trash. But, they are not

likely to find much popularity, as it is necessary to purchase these chemicals, whereas dung and water are ready at hand and more or less free of cost.

Conclusion and Recommendation.—The foregoing survey is an attempt to show, what a great part, the use of Synthetic Farm Yard Manure plays in improving rural economy. It makes good the deficiency of manure in the village and consequently saves Rs. 9,148/- annually by way of debt. It has another aspect also and it is sanitary; and it is no less important than the economic aspect. Cleaning of the 'Abadi' of the weeds, is expected to kill many disease carrying germs which will ultimately result in saving the village inhabitants and animals from frequent and disastrous outbreaks of epidemics.

Now-a-days, many official and non-official bodies are working for village improvement, a subject which is gaining increased importance and popularity, every minute, on account of its urgent necessity in India. Up to this time, little or no success is achieved in these attempts and some have even failed miserably as in Gurgaon. Every one among the interested people in the village uplift work, will realize that before actually tackling the real problem, the winning of the confidence of the villagers is quite an essential and fundamental factor. This is, as it were a stepping stone to the great task. Unless it has been proved by your actions and deeds and not mere words, that you are working with a selfless motive, the success is always doubted. They ought to be convinced that your undertaking is the outcome of that high, noble and inborn desire, from within to elevate and serve humanity at large and that it has nothing to do with the attainment and fulfilment of the self seeking ambitions. Then, of course your lead can be appreciated and followed. The success of any work in this direction depends on the success of this step.

There can be no other direct way of winning the confidence of common people, than to help them either in earning their bread more easily and efficiently or nurse them on the sick bed. The latter method is generally resorted to by missionaries with success. The economic helping is to some extent achieved by the use of Synthetic Farm Yard Manure as it tends to raise the income of the village by 28%. Hence the importance of recommending the use of Synthetic Farm Yard Manure in "Village Uplift" problem of India.

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CABBAGE

By Dhannalal, L. Ag.

Botanical name :—Brassica Oleracæ.

Natural order :—Cruciferæ.

Vernacular Name :—Patta Gobhi.

History.—Alphonse de Candolle (Origin of cultivated plants) is of opinion, that the present cultivated form of cabbage has descended from the wild form found growing on Mediterranean coast from centuries back Some other Historian, maintains that the present cabbage variety is originated from wild sea cabbage (Bolericea which was found on the sea coast of England and various other parts of Europe. The latter information seems to be correct as the plant still retains its original wild habit. The cultivated varieties of to day have departed from the original form to a very great extent. Cabbages really belong to countries which have a cold climate and naturally every country having a cold climate grows it. Its cultivation has now spread far and wide. Belgium, Germany and China grow it in large numbers and they have their own name for the cabbage grown there. Brussel Sprouts belong to Belgium. The terminal leaf bud variety is largely grown in Germany, while Chinese cabbage is found not only in China but in various parts of the gobe. In India too various varieties have been imported and the cabbages now form a very important culinary vegetable. C. P. too has cabbage cultivation in practically all its parts chiefly near big cities and towns where water and manure facilities are available.

Season.—The optimum climatic condition for the best growth of cabbage is cool moist climate which is generally found during the winter season. Hence Rabi season is the only season when it can be grown.

Varieties.—The strains used on the College Farm Nagpur were obtained from Sutton and Sons and proved quite successful. (a) Suttons Earliest:—undoubtedly it is the quickest growing cabbage. Habit dwarf, hearts tender and delicate in flavour but the chief merit is that they mature in a very short time. (b) Sutton's Best of all:—is a superior drum head type (c) Sutton's earliest of all—heads conical in shape, close and compact leaves pale and green.

Soil.—Light loam is considered to be the best soil for early crop but a heavy soil is suited for late crop. It is found cultivated on all kinds of soil in C. P. The results vary according to the soil conditions. On good soil in the case of early and late crop the heads are bigger and softer but on other soils they are comparatively smaller but there is not much difference and hence cabbages can be grown on all well cultivated soils.

Manure.—On the College Farm Nagpur, 20 cart loads of Farm Yard Manure are applied to an acre of land as basal dressing and Ammonium Sulphate 2½ to 3mds + Superohosphate 3 mds mixed are applied before earthing up. This scheme of manuring has given good results.

Nursery.—Cultivation starts with the 1st sowing of 8 to 12 oz. of seed in a seed bed in August and the seedlings from this sowing are being planted in Octber. The seeds are sown in beds in which they remain for about three weeks, by which time, the seedlings are ready for the picking out into 3' beds where they are spaced about 3"x 2". Seddlings transplated twice make nice healthy plants well furnished with a mass of roots and when finally planted will not only thrive better but yield finer heads then those left in the seed bed till required. Here they remain for a period of 2 to 3 weeks when they should be about 6" in height. It has been found that light shade is beneficial to the young seedlings during the hottest part of the day and also during rains. The seedlings will be ready after about 5 to 6 weeks from the original sowing for planting out in the field. One ounce of seed is supposed to contain 7500 seeds, which is supposed to produce 2000 to 2500 plants out of which some are discarded due to their weakness and hence one will obtain about 1200 good seedlings for planting. Seedlings suffer from Mustard Saw fly and diamond black moth grubs. Hand-picking early in the morning checks the trouble.

Cultivation.—The land is ploughed just after the harvest of the previous crop to a depth of 6" or 7" and then brought to a fine tilth by subsequent operations of bakhering and levelling. After the ground has been prepared as described, the surface pulverised and levelled, lay it out in Ridges and Furrows 2' apart either with E. T. plough or by hand labour in the month of October, any length which can conveniently be irrigated. To begin with, after the lay out, the area should be irrigated and the actual transplanting should be done in furrows. Transplanting is done preferably in the evening in order to avoid excessive loss of moisture by transpiration from the young plants. The spacing in the rows depends largely upon the variety. Early types may be planted as close as 15" but the larger growing sorts 20" or more. Close planting reduces the size of the head.

Subsequent operations.—Great care must be exercised to prevent the destruction of the roots. A soil mulch should always be maintained on the cultivated plot to prevent the growth of weeds and to aerate the soil either by khurpi or handhoe throughout the growth of the crop. It requires two weedings and may vary according to the condition of the field. Earthing should be done when the plants have half grown.

Irrigation.—Water is of extreme importance in raising a crop of cabbage. Too much water encourages successful growth. A careful eye should be kept on the field condition and watering should be done as soon as the field shows the least sign of dryness. In the beginning, irrigation is given after every week but later on after every 10 or 12 days. The best way to irrigate a field is to divide it into small convenient sizes, the size of the bed varying according to the nature of the soil. In sandy soils very small beds are made while in heavy soil the beds are somewhat bigger.

Seed raising.—When the heads reach their maximum solidity cuts are given. This facilitates emergence of the stalk from the head. The emerged stalk bears the blossom and after fertilization seed formation takes place. The seeds on maturity are harvested and stored in bottles.

Harvesting.—About four months after transplantion the crop gets ready for harvest. The heads are harvested as soon as they reach maturity. The best time for harvesting each head is when the head reaches the maximum solidity and it may be bent over and severed from the stem and the basal leaves with a sharp knife. The number of good heads obtained from an acre after making an allowance of 20 % for unsaleable heads is 10454.

Pests.—Cabbage butterfly caterpillar feeds on leaves and completely defoliaties the plants. Shaking the caterpillar in kerosinized water is recommended.

COST OF CABBAGE CULTIVATION

		Rs. a. p.
(i) Manuring :—		31 14 0
(a) Cost of 20 C.L. of F.Y.M. @ 1/8...	30 0 0	
(b) Spreading charges 10 women@ /3/-	1 14 0	
(ii) Preparatory tillage with bullocks and iron plough :—		5 6 0
(a) 2 pairs of bullock @ 1/8/- per day.	1 8 0	
(b) 3 men @ -/5/- per day	0 15 0	
(c) Depreciation and interest Area ½ an acre per day.	0 4 0	
(iii) Bukherings :—		3 12 0
(a) 1 man @-/5/- (b) 1 pair of bullock -/12/- (area 1½ acre.)		
(iv) Fertilisers :—		24 2 0
(a) Ammonium suphate—240 lbs. @ 5/1/- per md.		
(b) Superphosphate 240 lbs. @ 3/12/-per cwt.		
(c) Spreading charges 2 men @ -/5/- each per day.		
(v) Opening furrows with an E. T. plough and making beds and Channels :—		2 15 0
(a) 2 men -/10/- (b) 1 pair of bullock /12/- (c) 5 men to mend 1/9/-		
(vi) Cost of 10 oz. of seed @ Rs. 4/- per oz and the charges for raising the nursery.		55 0 0
(vii) Planting :—		7 1 0
(a) Uprooting of seedlings 2 men -/10/-		
(b) Selection of seedlings 1 man /5/-		
(c) Making holes 10 men 3/2/-		
(d) Planting seedlings 16 women 3/-/-		
(viii) Irrigation		26 6 0

(a) The depth from ground level to the water level was 20' to 25'; 50 buckets of 1½ gallon raising 3000 gallons water per hour were used. By means of this Persian wheel one will irrigate one acre in about 1½ days, working 8 hours a day. Labour units, 1 pair of bullock -/12/- 2 men -/10/-. Hence for 9 irrigations the amount comes to Rs. 19/4/-

(b) Depreciation and interest per acer per annum taking 8 acres to be managed under one Persian wheel costing Rs 240/- is Rs. 4/9/6.

		Rs.	a.	p.
(c)	Depreciation on well costing Rs. 400/- is Rs. 2/8/6.			
(ix)	Weeding and mulching :—48 women @ -/3/- per day.	9	0	0
(x)	Earthing 10 men @ /5/-	8	2	0
(ix)	1 man to look after the crop for 2 months (which includes harvesting of the heads as soon as they get ready).	20	0	0
(xii)	Land Revenue	5	0	0
(xiii)	Interest on Rs. 200/- @ 7½ % and other charges	16	10	0
	Total cost of cultivation	210	4	0
	Amount realised by sale of the crop ...	310	0	0
	Nett profit	99	12	0

IMPORTANCE OF GOOD SEED AND SUPPLY OF IMPROVED SEEDS IN CENTRAL PROVINCES AND BERAR

By B. S. Rao. L. Ag. (Hons).

What is a seed.—From a Botanist's point of view a seed is a fertilised ovule which on maturity is capable of giving rise to a new plant under proper conditions of moisture and temperature, but in the case of many plants (sugarcane, potatoes, garlic etc.) certain vegetative parts, like the stem, modified shoots etc are used for propagating the plants as the plants either do not produce seeds or if produced the seeds may not be fertile. Propagation of such plants has of necessity to be attempted only by vegetative method. Sometimes although seeds may be produced from which plants may be raised still on account of other considerations like earliness in growth, size of produce, etc. vegetative parts are used for propagation. From the farmer's point of view a seed is any part of the plant, the fertilized ovule, or a portion of stem, or a modified shoot which he has to sow in order to produce a crop.

Importance of good seed.—The child is said to be the father of the man. The seed may be called the father of the crop. "As you sow, so you reap" is an old adage the significance of which cannot be over estimated

in crop production. All efforts in the shape of cultivation, manuring, irrigation etc will be wasted if the seed which the farmer sows is bad.

What is good seed.—The farmer sows the seed and will be longing to see the seeds germinate and grow into healthy plants. He is sadly disappointed if the seeds fail to germinate or the plants, with all care bestowed on them, fail to grow well. Good germination and healthy growth of the seedlings depends upon the "Soundness" of the seeds. In order to be sound, seeds should (a) not be damaged in condition and (b) possess vitality.

By vitality is meant the ability of seeds to germinate quickly and supply sufficient nourishment to the young plants till they are able to live an independent existence. Seeds loose vitality with age. The longevities of different kinds of seeds vary. Some seeds retain their vitality for 20 years while others fail to germinate when not sown immediately after harvest. Some authors think that smaller the seeds the shorter their life. How far this statement could be taken as a general rule is difficult to say. For instance tobacco seed which is very small has been found to retain vitality for 8 to 10 years while the mango seed looses vitality within 2 months and the Jamberi seed, within even a shorter period. The Mummy wheats which have been taken out after several centuries have been found to give rise to plants bigger than the biggest variety of wheat cultivated at the present day. Did the people in the past treat the seeds in some way to impart to them long life? Research in this direction will be very useful.

Loss of vitality.—Although longevity of seeds may vary all seeds do deteriorate or loose their vitality if not stored properly. If seeds get damp the tendency is to sprout and changes take place in the contents of the seed. The vitality is lost. Some seeds have also been found to loose their vitality if subjected to high temperature for a long time. On the Adhartal Farm, paddy has been found to suffer in vitality when the galvanished iron bins in which it was stored was kept in a granary made of tin sheets. The crop meant for seed should be harvested when quite mature. Else as the seeds contain a lot of moisture they deteriorate. Cotton seed from the first picking is generally not used for sowing, one of the reasons being that it contains a high percentage of moisture due to which the seeds deteriorate during storage.

Damaged seed.—During storage insects should be excluded. Insects may either eat away the embryo in which case germination is impossible or they may eat away the cotyledons thus robbing the young plant of the

food material stored for its use till the plant is able to draw nourishment from the soil. The starved plant either dies or grows very slowly and is unhealthy.

Vegetative parts like tubers, bulbs, stems, etc. which are used for propogation require special methods of storage as they are easily damaged by, insects, fungi and bacteria. Seeds which are treated with chemicals, with the object of killing spores of diseases sometimes loose their vitality. Jowar seed treated with copper sulphate solution should be sown immediately. Else the treated seeds loose their vitality.

Seeds should be pure.—Many cultivators, on account of want of facilities for storing seeds in their homes, or on account of poor harvests, or increased consumption of grain by the family during the year, are required to purchase seed from outside agencies. Apart from the question of the seeds possessing vilality which aspect has already been discussed the purity of the seeds available in the market is an important factor. A sample of seed may be impure on account of :—

(*a*) Other kinds of seeds being present, for instance in a sample of Jowar seed, the presence of Castor, Tur or Cotton seeds.

(*b*) Other varieties or strains of the crop. In a sample of Roseum cotton seed presence of seeds of Malvensis or Buri types, or in a sample of Verum 434 seeds of Verum 236. This is what is known as the seed "not being true to type."

(*c*) Seeds of weeds. Chandwel seeds in a sample of wheat or seeds of dodder, in consignments of clover seed imported from Alexandria.

(*d*) Stones, earth, ash etc which sometimes due to improper harvesting, threshing and winnowing find their way into the seed stock, but are in many cases deliberately mixed with the seed by unscrupulous dealers.

The disadvantages of purchasing impure seeds are obvious. It is difficult to adjust a proper seed rate, extra expense will have to be incurred for weeding, cost of seed will be high as a portion of the cost will be for the lot of weeds, earth etc which are not wanted, the resulting crop will not be uniform in standard and the harvested crop being a mixture will not get a good premium in the market.

Seeds should be free from diseases and pests.—Many of the diseases

(fungus and bacterial) and insect pests which take such a heavy toll of cultivated crops are borne by seeds. The seed sown may itself be diseased as in the case of red rot of sugar cane, or the ring disease of potato or the seeds may carry the spores of diseases. The spores germinate in the soil and attack the young crop. Jowar smut is a good example. Pests are similarly borne by seeds. Seeds may carry with them either the eggs or the active insects or insects in a state of Hibernation. Therefore it is very important that seeds used should be free from insect pests and fungus and bacterial diseases.

How to have good seed.—It is always advisable not to reserve for seed purposese crops from areas where diseases are prevalent. The crop meant for seed should be healthy and all the plants in the field should be of one type. The crop should be harvested when quite mature and thershed separately and carefully so that it may not get mixed up with other seeds or be injured during threshing. The seeds collected should be stored properly. In order that the crop meant for seed be healthy, the land chosen should be good, well manured, carefully cultivated, the seed sown at proper time, and carefully looked after.

As the object is to collect the seeds of only one good type, plants of all other types which may be found should be carefully removed if possible before they produce flowers. This process is what is known as "roguing." If a crop is harvested when it is immature the seeds will not be found fit for propogation purposes. This applied to the regular seeds and also to vegetative parts which are used for seed purposes. Potatoes, Arum, Termeric etc. when meant for seed are allowed to remain under ground for longer periods than when meant for consumption.

Threshing of seeds meant for seed should be done carefully to prevent admixture of other seeds or varieties. This is likely to be the case where for want of sufficient room the harvested varieties cannot be kept separately. After each variety is threshed the threshing floor and the threshing machines should be carefully cleaned so that no seeds may be left behind. This is very important in ginneries where several people take their Kappas for ginning and the resulting cotton seed is generally mixed. Injury to seeds thus rendering them useless for sowing purposes also results if threshing is not done carefully. This happens specially when machines are used. In cotton gins also many seeds are broken during ginning. The thin covering of the ground nut seed is very important. If it is removed the seeds will not germinde.

Methods of preservation and storage are very important to ensure the success of seeds meant for sowing. The receptacles in which seeds are stored should be air tight and damp proof. The size of the receptacles depends on the quantity of seeds to be stored; for small seeds, like tobacco glass bottles provided with good stoppers will do. Galvanised iron bins are generally used on Government farms and are quite satisfactory. A bin 6 feet high and ¾ feet diameter can hold 3000 lbs of wheat, or 2400 of paddy. Seeds stored in bins are also safe from fire and theft as the lids can be tightly fastened and locked. It costs about Rs. 45/- and will last fore 30, years at least. In the Punjab, special cement concrete Kothies are being constructed to store large quantities of wheat.

The seeds before being filled in the receptacle should be well dried in the sun so that (a) moisture which is injurious may be driven away and (b) insects which damage seeds be driven away and sometimes even be killed by the heat. Experiments conducted on the Akola Farm Show that in the case of cotton boll worm, the grub which inhabits the cotton seed is killed, if the cotton seed is spread in the strong sun for six hours.

Mere drying in the sun will not be (except in a few cases) effective in killing the active insects and their eggs. They should be killed by the use of chemicals. Carbon-bi-Sulphide is useful for this purpose. But at, it is a highly inflamable liquid, it should be used with care. The seed os be treated is put into a bin and the required quantity of Carbon-bi-Sulphide is poured at the top of the seed and the lid is quickly closed and hermetically sealed. The heavy fumes descend and permeate throughout the mass. All insects and even their eggs are killed. After 25 hours, the seeds should be spread in the sun for a couple of hours so that all the Carbon-bi-Sulphide might escape and then the seeds put back into the bin quickly and the bin properly closed again. The treatment with Carbon-bi-Sulphide does not in any way interfere with the germinating capacity of seeds treated. For every 15 cubic feet of the bin, ½ ounce of Carbon-bi-Sulphide may be used.

In the case of Jowar seeds treating them with copper carbonate or sulphur in the form of dry powder is effective in not only killing the spores of smut which may be found on the grain, but also in acting as a deterrent to insects which damage the stored grain. The quantity of Copper Carbonate required is ½ ounce per every 12 pounds of grain.

In the case of seeds which are imported from other countries, they are subjected to fumigation at the ports in specially constructed sheds where cyanogen is evolved to kill the insects.

Dry neem leaves, ashes, Naptha pills etc., can also be used as deterrents with some profit. Seeds are sometimes smeared with castor oil to keep away insects.

A method which has been found out recently is to subject the seeds, to be preserved, to high power, high frequency radio waves. High power short wave radiations effectively destroy insect pests, including eggs without any damage to the seeds. The seeds are treated for only 6 seconds. It has been found that by this treatment, the germinating capacity has been enhanced.

In the case of seed potato, termeric, etc., special methods of storage like underground, pits, sand trays etc., have to be thought of.

So when a cultivator purchases the seed he requires he has to satisfy himself that the seed is (a) Sound and (b) Pure.

Sources of seed supply.—Some cultivators try to reserve a portion of the annual harvest for the following year's sowing. Very often on account of failure of crops, financial difficulties etc, the cultivators consume all they grow and are required to purchase seed from the village Bania. Attempts are being made to supply seed to the farmers by means of seed and demonstration farms established by the Governement, seed unions and by private certified seed farmers. Seed storage by the cultivators themselves should be advocated provided they can grow a pure crop and store the seeds properly. Seed purchased from the Bania is never satisfactory as the seeds of different years are mixed, different varieties are mixed, or, damaged by insects, contain earth, weeds etc. The seeds from Government Seed Farms are always reliable as all possible care is taken to keep the crops pure and store the seeds properly. As the certified seed farmers and seed unions take pains to keep their crops pure and replace their own seed from Government Farms from time to time, and their method of storage are approved by the Government, seeds from such unions and seed farms could be depended upon to give good results.

In the Central Provinces, there exists a Government Seed Farm in each district and in addition there are several certified seed farmers and seed unions. But, considering the amount of seed that is required annually the supply of guaranteed seed is small. When the average cultivator will begin to differentiate between the seed obtained from the Bania and that obtained from seed farmers and will not grudge paying higher premium for the latter's seed, many enlightened farmers will begin to grow good seed. Unless there is a demand for good seed there

cannot be agencies for increasing the supply of good seed. A "Good Seed" sense has to be cultivated among the farmers.

Seed Testing.—It is easy to say by looking at a sample of seed whether it is a mixture of types, contains foreign material, is damaged by insects etc. A magnifying glass will be useful in judging small seeds particularly. Seeds should be plumpy, and shining or as they say, "bold". Old seeds or seeds obtained from an immature crop or seeds which during storage have become damp, appear dull and shrivelled. Certain chemical methods have been suggested to find out if the seeds are old. Seeds are steeped in certain coloured chemical solutions. The extent to which the colour penetrates the tissues of the seed is considered to be an indication of the age of the seed, older seeds getting stained quickly. Indigo carmine and Sodium Tellurate are the two substances suggested. Half a tea-spoonful of Indigo carmine is dissolved in a gallon of water and the seeds put into the liquid. If the seeds have a dark seed coat the seeds should be broken and then put into the liquid. Fresh seeds resist the penetration of colour while old seeds get stained quickly. One percent solution of Sodium Tellurate at 16° C. darkens living embryo in 48 hours, and then the depth of colour remains constant. The depth and extent of colour change is correlated with vitality.

In the case of tobacco seeds if the seeds are sound, a cracking sound is produced when the seeds are thrown on a heated poker. If they have lost their vitality, they simply get burnt and do not produce any cracking report.

Seeds which are bored by insects or seeds which have not properly filled are light in weight. Before sowing it is advisable that such light seeds are eliminated. In the case of some seeds like paddy, jowar etc seeds are thrown into saturated salt water. All those seeds which do not sink but float on the surface are separated out. The heavy seeds should, then be sown immediately or dried in the shade and kept for sowing. Germination tests on blotting paper and in sand trays are very useful in giving indication regarding the value of a sample of seed for sowing.

Rejuvenation of Seeds.—Can seeds which have lost their vitality be rejuvenated? If it is possible to restore them to activity by treating them electrically or by chemicals etc., it would be a great help. A curious instance has been cited in one of the Annual Reports of the Department of Agriculture, Punjab. Senji seeds which had lost their vitality are reported to have regained vitality when they were put in an empty

cigarette tin and violently shaken. Research in this direction in worth following up.

What are improved Seeds.?—In every tract, certain varieties of crops which have been found to do well in the tract are being sown by the farmers. These types might have been the best of what the farmers could get hold of in their isolated condition and without any assistance from any agency like the present day Agricultural Department. These varieties became long established and began to be known as "standard varieties". But, during the last 25 years state of things has changed considerably. Exports have increased. High yielding types having the required qualities demanded in the distant markets, types which can respond to intensive methods of cultivation and types that can resist diseases and climatic variations are required so that the cultivator may, instead of remaining satisfied with a small harvest to keep his body and soul together, improve his standard of living and lay by something besides. Scientific discoveries have made it possible to bring into existence types of plants which possess the qualities required. By methods of selection, hybridizations, grafting and introduction of exotic (plants from other countries), the Agricultural Departments in India have been able to give to the cultivators more profitable strains of crops. These strains which are superior to the types generally grown by the cultivators, with reference to qualities like yield, resistance to diseases water logging and drought, percentage of oil content etc., are known as improved seeds. As improvements are sought after by those engaged in the task, a variety which on account of its qualities was ushured by the Agricultural Department and became established as a Standard Variety may in its turn be displaced by something better. Khari variety of cane which displaced local canes 25 years ago in C. P. was in its turn replaced by the Coimbatore canes a few years back.

The Agricultural Department may evolve a useful type by Hybridization or by mere selection and after multiplying the seed in sufficient quantities, distribute them among the cultivators for sowing. If after this, the Department should expect the cultivator to depend on himself for future seed supply and purity of seed, then the trouble taken by the Department in evolving new types will come to nothing, for the cultivator cannot watch the crop sufficiently carefully to prevent admixture with other varieties. Sometimes during a famine year, satisfaction of hunger being a more pressing necessity he may consume all the grain and have no seed left for sowing. A 115 known as Sharabati wheat which is one of the best wheats evolved by the C. P. Agricultural Department is said

to be deteriorating. This is due to the seed getting mixed up with other types in the cultivators field. Hence it has been found very necessary that each farm should, apart from its other routine work, specially be held responsible to keep a particular variety of crop true to type and try to raise its standard of excellence by proper roguing and selection. These farms are known as, "Parent Farms". For instance in the case of wheat, Seoni is the "parent farm" for A. O. 68; Betul for A. 113; Adhartal for A. O. 90; Chhindwara for A. O. 49 and Hoshangabad for A. 115.

Seeds deteriorate when grown too long on a particular area. Seeds require a change just as human beings are advised to have for recuperating their health. Seoni sends its seeds to Saugor Farm and vice versa periodically for this change. Where one finds yields decreasing he will do well to exchange seeds from someone at a distance who grows the same variety.

A good variety should be made to "stay" in the locality into which it is introduced. The "Barhi" system of seed distribution (which due to certain reasons had to be suspended since recently has been useful in achieving this end. The Government advances to cultivators the seed required for sowing when they have no seed of their own left due to any reason. The Government hands over the improved variety of seed. To get the benefit not less than 5 persons should jointly apply for an advance of seed. They are individually and jointly responsible for returning the seed given to them, the quantity returned being 10% more than the quantity which was advanced. The seed is not accepted back after the very first harvest but the cultivators are expected to return the seed in 11 annual instalments and the seed returned should be of the type lent by the Agricultural Department. This is to compel the cultivators to grow for at least 11 years the kind of seed advanced so that they may be able to see for themselves the good qualities of the "Sarkari" seed which would be lost sight of if the cultivators returned the quantity borrowed after one year only. The Barhi system of seed distribution bears an analogy to the agreement system of water supply of the Irrigation Department by which the Irrigation Department tries to inculcate the Irrigation habit "into the cultivators" agriculture.

(To be continued).

Extracts

CROP INSURANCE AND ITS EFFECTS ON AGRICULTURAL STABILISATION IN INDIA

BY Prof. B. MUKERJEE, M A. P.R.S., F.E.S.

In this article the author gives an account of a remarkable experiment which has been recently started in America for the purpose of building up a greater agricultural prosperity in the country through a system of Voluntary Crop Insurance. The ultimate success or failure of the scheme will have far reaching consequences on every agricultural country. As such India should watch with keen interest the result of this experiment in America and if possible to improve her rural economy and prosperity by a scheme of Voluntary Crop Insurance.

The great object of the scheme is to insure for a evernormal granary in the country. The main idea is to provide for the insurance of crop yields without insurance of price. This is achieved in the following way. In bumper years the farmer will be required to deliver to the Government a certain percentage of his surplus crop i.e., of the amount in excess of his normal yield. This surplus will be stored by the Government in warehouses and elevators specially constructed for the purpose. In years of crop failure, the Government will re-deliver to the farmer enough of the crop—or its equivalent in cash—so as to give him 75 per cent of his normal yield. The scheme purposely does not give the farmer enough to provide him with the full normal—100 per cent—crop. Because if the farmer is wholly protected against loss he might lose all incentive or interest in getting for himself a full normal crop. He might even not try to get a crop at all in bad years. This explains why individual crop-yields are under-insured so that the farmers might be required to carry a part of the risk themselves. This would prevent them from neglecting their crops or their cultivation.

It has been calculated that insurance for all the staple crops in America, can be made self-supporting if the initial cost for the first ten years—estimated at 5 millions a year, could be met by the Government. The scheme applies to all the staple crops including wheat, maize, cotton, and corn. It would work as follows:—

1. Every farmer who applies for Government Insurance would have his premiums fixed in kind according to the nature of his holding and the average crop out-turn. It may even be payable in cash.

2. The Government may either store in the warehouses the corn received as premium and may even add to it by purchasing corn wherever payment in cash is made.

3. When the insured farmer gets a crop lesser than his normal crop, he will get a certificate drawn on the Government representing the difference in the yield. He may sell it directly or may get the actual stuff and sell it himself.

Simultaneously with the crop insurance scheme, the system of crop control which is intended to prevent excessive accumulation of surpluses will also continue.

The advantages of the scheme.—The social and economic advantages that shall follow as a result of the above arrangement are manifest. They will hold good not only in America but also in every other country. They may be briefly stated as follows:—

1. It will ensure a steady and normal food supply in the country. This will stabilize the supply of agricultural produce.

2. It will protect the consumer from wide and constant fluctuations in prices due to the changes in the supply owing to total failures of crops or short crops.

3. It will yield a more stable income for the farmer by protecting him against the chances and vicissitudes of the seasons. It will minimize the hardships of the bad times. The stability of income of the agricultural classes would mean agricultural prosperity.

4. It will save the agriculturists from the over-whelming weight of indebtedness in years of crop failures.

5. The farmer will be assured of enough resources to live on and maintain the usual standard of living for himself and his family. The importance of this help is to be gauged in the light of the great agonies that one has to suffer when he is deprived of his regular share of the joys and happiness of life.

6. It would stabilize the purchasing power of the cultivators, by making it even from year to year. When the agricultural classes suffer from such a fall it ultimately recoils on the interests of the other classes as well. It is the trade and industry of the country that is thus saved from the effects of a depression.

7. Ordinarily a farmer is very likely to spend away his surplus that he gets in a good year. This is particularly in case of the commercial

crops which may fetch him tremendous profits if the price or the cultivating conditions are favourable. The insurance of this nature will obviate the possibility of spending away in good years. Thus the farmer will be made more fit for concentrating on the money crops though they involve the above mentioned risks which ordinarily would dissuade a farmer due to the risk of loosing everything.

8. Lastly it will relieve the public treasury of the great expense which it has to meet from time to time in giving a helping hand to the agriculturists by means of famine relief, takavi loans, advances to co-operative societies etc., nor the danger of the losses to the treasury due to suspensions and remissions of land revenue. Thus the system will save the state finances from being so uncertain as they are to-day.

Essential requisites of the scheme and the difficulties in India.—A vast amount of actuarial research is needed before such a scheme can be adopted. It would be necessary first of all, to find out the normal yield figure for each farm in each particular crop that it grows. This is a fairly difficult proposition in India, where most of the cultivators being illiterate—keep no accounts and have no idea of running the farm as a business. Further, conditions of cultivation vary so widely from one area to another, crop yields depend so largely on fertility, irrigation, rainfall, manuring, the system of rotation, facilities of communication and opportunities of scientific agriculture that it would be dogmatic to lay down any general formula that would apply accurately in all the cases. These difficulties are special to this country and are not found in America. Under these circumstances, it will be absolutely necessary to have separate calculations made on a strictly local basis.

The greatest difficulty will be that, in the initial stages of the introduction of this scheme. The very cultivators, in whose interest the scheme is prepared, will not be ready to take the benefit of it. This will be firstly due to their usual manner of doubting whatever is new and secondly because they have no understanding of the future and the need of storing up for being used then. They are absolutely devoid of what may be called the telescopic faculty in them. Another difficulty would be that viewing the present conditions the people can hardly make both ends meet and it would be too much to expect them to buy insurance by putting beside something which shall be beneficial to them in the unknown future. But in spite of the above difficulties, it may be said that whenever possible the people must be made to take the benefit of the scheme by inculcating in them the importance of providing for the future. If the cultivator does not move of himself, he will have to be led.

The problem of storage will also present a great difficulty. A great deal will have to be spent in the construction of warehouses and the cost of transporting the goods for storing purposes. The initial cost for these purposes, which is estimated to be nearly £50/- millions in America, has to be paid by the state. But this is possible only in America where the Government is financially very strong. It can hardly be possible in India where the financier is coming to his wits ends in managing the existing liabilities of the state. A special change will have to be made in India. The scheme should make very small beginnings by starting the work only in some selected areas where the agricultural conditions are more favourable and the premiums very low. The Government may then be able to finance such an enterprise. This help will surely benefit the Government ultimately as shown above. The Government of India might well appoint a special committee to consider the whole question in detail and find out how far it might be possible to adopt the scheme in India with such modifications as may be found to be necessary on practical considerations.—(*Indian Journal of Economics, January 1938*).

OUR EXPANDING FARM MARKETS

Chemistry seeks new uses for products of the soil.—The decrease of natural resources in this country has made industry turn for help to the organic chemist to see if he and the farmer—the greatest producer of raw materials in the world—can't get together and use up more farm products. Even now, some of the by-products of the farm are being converted into things more important than the original crop.

Chemists are staying awake nights trying to find ways and means of reproducing or changing nature's products for functions entirely separate from their uses as food for men and animals. As you know, 15 per cent of the corn crop is now converted to industrial purposes; and the phenomenal growth of the soy bean crop in the past few years is due, in part, to its many applications discovered in the chemical laboratory.

Chemistry can separate atoms one from another and recombine them in such a manner as to build up materials which will be more useful, more available, less costly, or more suitable than those conveniently found in nature. It can even produce many new substances which have been found nowhere in nature. All such new and old compounds are called synthetic—that is, they are mixtures of simple elements into complex substances.

Crops as starting materials.—Agricultural products provide starting materials from which science, especially synthetic chemistry, can get a great many valuable products, such as the two carbohydrate neighbours, starch and sugar, as well as cellulose, which grows in its purest form as wood and cotton.

Molasses, a by-product of sugar refining, is the basic raw material of the alcohol industry and, together with corn and other grains, supplies numerous important solvents, or dissolving substances, to industry. Corn, subjected to mechanical and chemical treatment, produces dextrin, adhesives, and corn sugar (glucose), as well as oils and solvents. From corn is produced a rubber substitute; and corn proteins are used in finishes, plastics, food coating, and chewing gum.

All denatured alcohol comes from either grain or blackstrap molasses, a product from cane.

The hulls of oats yield furfural, an important starting point for making plastics, and used to a great extent in purifying lubricating oils. Furfural is also made from corn, wheat, rice, cottonseed, and sugarcane. Fibrous stalks, such as waste sugarcane, from which the sugar has been extracted, from the raw material for making useful wall board and insulation. The waste skimmed milk of creameries is treated to produce both milk sugar and casein, and the latter is the base of adhesives, plastics, and quality paper coatings, and even the raw material for a "synthetic wool" in Italy. Skimmed milk and soy bean meal are sources of casein glues. Starchy vegetables, especially corn and potatoes, supply dextrins and other modified starches of valuable adhesive properties.

Soy beans, tung nuts, maize, cottonseed, flaxseed, and castor beans are some of the crops that yield valuable oils. Artichoke, Perilla seed, and peanuts are among the long list of other farm products that have industrial possibilities. Peanuts, for instance, can be turned into 300 useful products, including wood stain, cloth dye, linoleum and synthetic rubber.

A result of chemical experiment has been the recent development of the paper industry in the South, supplied by slash pines which grow so fast they may almost be considered a farm crop. Within two years, sixteen new mills have been launched in the South, all using southern pine as raw material. This country need never again be dependent on outside nations for sources of wood pulp.

Cotton.—As a by-product of the utilization of cottonseed, large quantities of linters (cotton fibers left on the seed by the gin, but too short for use by the textile industry) are recovered. These are admirably adapted to the use of the chemical industry in the manufacture of the synthetic fibers of rayon plastics of the celluloid type, and the nitrocellulose used in quick-drying lacquers and in smokeless powders. Exploring the mysterious realms of atoms and molecules, chemists know how to take plant cells apart and then put the material together again to make pyroxylin, an entirely new substance.

Pyroxylin in transparent or coloured form is molded into toiletware, pipe stems, hair ornaments, toothbrush handles, and an endless list of other objects. Transparent sheets of it are sandwiched between two plates of glass to make shatter-proof safety glass. Other cellulose products are moving picture films, finishes to take the place of paint and varnish, transparent cellophane wrapping used so extensively in modern packaging, and rayon, the chemically made yarn.

Rayon is a strong, smooth, cylindrical fiber made by man in about the same way that nature makes silk. Man gets cellulose from wood pulp and cotton linters: nature uses the leaves of mulberry trees to produce protein silk via the silkworm.

When man makes these fibers, their dimensions, strength, and other characteristics can be varied at will. Furthermore, rayon is uniform, since its production can be controlled all the way. Most important, it lends itself to combination with silk, wool, and cotton.

Rayon is a truly synthetic fiber. It serves in products varying from parachutes for aviators and wall papers for homes to ribbons for typewriters, linings for coffins, fish nets, and tennis racket strings. So far, rayons have about 450 uses. Tire manufacturers are testing tire cores composed of high-heat-resistant rayon.

Weather-resistant cellulose garments, with perforations around the bottom of the "skirt," are proposed for fruit trees. Attacks by insects will be thwarted, and an application of spray on the material to last several days will carry each tree through a cold snap.

One scientist has made the statement that, apart from the uses of cotton linters as vegetable fiber, there should be 3,000,000 new acres of cotton within the next ten years to fill the need for a material to be used as a foundation in road construction.

Soy Beans.—To date, no farm crop is so well fitted for use in industry as the soy bean. Aside from its high value as feed and its place in the human diet from soup to nuts, products made wholly or in part from soy bean oil and meal include "everything from hay to hairpins,"—soaps, paints, varnishes, lubricating oils, a binder for cores in iron foundries, plastics, paper sizing and coating, glue, rubber substitutes, printing inks, wall coatings, insulating material, linoleum, glycerin, and hundreds of others.

A lustrous, tough and permanently elastic enamel derived from soy bean oil has a special place in the automobile industry. Refrigerators finished with baked soy bean synthetics have a true porcelain appearance.

Soy bean production is at present concentrated largely in the Corn Belt states, but this valuable crop is also grown to advantage in the South, usually in rotation with cotton.

Sugar.—Chemistry is keeping a more or less optimistic eye on two sugars: dextrose, from coron, and levulose (fructose) from the Jerusalem artichoke. Dextrose already has won a considerable market in the candy and bakery trades, and in canned and preserved goods. It is only about three-quarters as sweet as ordinary sugar, but that characteristic gives it an advantage in some cases, such as in the manufacture of certain preserves and candies which heretofore have been too sweet. However, for general household use, dextrose is not, and probably never will be, sweet enough.

Oats.—Raw oat flour, sprinkled on or mixed with various kinds of foods, keeps them from growing stale or rancid rapidly. Potato chips, coffee, bacon, salted nuts, salad dressings, margarine, and other foods offer a brand-new outlet for this flour; it can even be milled right into oiled wrapping paper and thus aid in keeping butter and other products fresh and sweet.

Another use has recently been found for furfural, obtained from oat hulls, in the treatment of bathing beaches to prevent "swimmer's itch." The same chemical is used in swimming pools, locker rooms, and other sites of possible infection to prevent the spread of "athlete's foot."

Flax and Hemp.—Seed flax for linseed oil is grown in many sections of the Northwest, and in the far west. A new use for flax fibers in the production of fine quality, lightweight papers, such as cigarette paper, seems to be starting. California is now growing flax for this purpose, and the crop is being revived in Oregon, as well.

Similar thin papers also can be made from hemp. In Minnesota, some hemp is under cultivation for this purpose. Scientists have shown that American flax and hemp fiber is suitable for the making of lightweight paper, and they state that the industry eventually can use fifteen to twenty thousand tons of this fiber yearly, when and if it is grown.

Plastics.—The name plastic is used for any molded substance which begins as some common place raw material—such as wood fibers, soy beans, the stalks of various plants, cotton, or furfural and then passes through complex chemical processes to become finally a tough, solid material which is pressed into all sorts of products. Only fifteen years ago, the plastic industry was still a small one, chiefly interested in making buttons from milk casein. Now from cellulose materials come clock cases, door knobs, ash trays and ornaments of many kinds, radio parts, portions of furniture, dishes, automobile parts, and hundreds of other things.

There is talk of using sheets of plastic for building purposes, particularly for insulating and interior work. Nearly all the automobile manufacturers are employing plastics to some extent. Soy beans are used for making molded products such as gearshift knobs, horn buttons, electrical switches, and distributor cases. Great molding machines are going to make automobile window frames out of soy bean stalks.

Certain corn proteins are said to be an ideal base for plastics; this field, if it is developed, does not promise a greatly increased corn production, however, because removal of the proteins has very little effect on the value of the corn products already being marketed by the corn refiners.

But what agricultural raw materials will finally emerge triumphant in the plastic industry is yet to be seen.

Agricultural advancement begins in the laboratory, where industrial chemistry sees endless possibilities in finding ways to extend the use of farm products and by-products, old or new.

This chemical age.— We seem to be approaching an age in which finished goods are to be chemically wrought to serve our purposes. The idea of growing the organic chemicals contained in farm products, to be processed into an array of compounds fit for the uses of industry-compounds that will outstrip, in quality and suitability, products made

of inorganic matter —may mean that nature's ores and minerals now taken from the earth will be superseded in volume some day by the vegetable matter produced on the farm by man. By combining the talent of its research laboratories, the productive capacity of agriculture, and the resourcefulness of industry, applied chemistry may have discovered a formula that will advance our standard of living beyond any that we have known. (*By Richard, L. Brown—Extract from the "Furrow" January—February 1938, Vol. XLIII*).

THE DELHI CATTLE SHOW

Tribute to the high quality of India's cattle was paid by Col. Sir Arthur Olver, Animal Husbandry Expert to the Government of India, in a recent broadcast talk from Delhi in connection with the Cattle Show, which was held last month in conjunction with the Horse Show in Delhi.

"An All-India Cattle Show is an entirely new departure. It is hardly necessary to explain that the purpose of all such shows is to encourage competition between breeders, in order to raise gradually the stock to the highest levels of efficiency for the particular functions they are required to perform" said Sir Arthur Olver.

In all countries where high class stock are now produced, the present levels have been reached very largely as a result of competition at such shows, but it is essential that the lines to be followed in judging should be clearly defined for each breed. With this in view the Imperial Council of Agricultural Research have taken up the official definition of breed characteristics for 8 of the most important milch breeds of pure Indian cattle and buffaloes and a special bulletin has been prepared, giving a brief description with photographs of representatives of 25 of the best known breeds.

Breeding conditions changed.—In the past, cattle breeding in India has been largely in the hands of professional breeders, by whom the breeding and management of cattle under semi-wild conditions was a well understood and profitable undertaking. As the best natural grazing areas have been brought under the plough, the breeding of good animals under these conditions has, however, become more difficult and less profitable. Probably the greatest of all the problems of India to-day is to develop a system of mixed farming under which cattle of high class—for milk production or for work could be profitably bred and maintained, on comparatively small holdings. By the

proper use of specially grown fodder crops, such crops would fertilize the land and supplement the meagre grazing and residues of grain crops on which cattle are mainly fed during the winter. It is quite impossible to breed good cattle in most parts of India though it is true that there are areas where, due to mineral or other deficiencies, cattle tend to degenerate unless specially fed. But these deficiencies can be overcome and there is ample evidence that it is a mistake to suppose that, apart from areas where the rainfall is excessive, high class cattle, of suitable indigenous breeds, cannot be satisfactorily bred and reared in most parts of India.

But you want good cows.—Some of the best cows of pure Indian blood give high yields of milk, far higher in fact than the averages of commercial dairy herds of Europe and America. By systematic selection and proper feeding and management several herds of pure breed Indian dairy cattle, have in fact been built up in less than 25 years, whose average yield is above the average yields of European cattle which have been subject to selection during a much longer period of time.

It has been shown that, with proper management, carefully selected pure-bred Indian dairy cattle can produce butter-fat more cheaply in India than imported European cattle, though these ordinarily give a higher yield of milk. It ought to be much more generally known than it is, that the milk of Indian cows is much richer in cream than that of European breeds. The average percentage of butter-fat in the milk of Indian cows is about 4.8 per cent while that of cows in Europe and America averages about 3.7 per cent.

The best are "best."—It is well recognized also that the best Indian breeds of draught cattle are probably the best in the world. In recent years it has been proved, by carefully controlled experimentation, that Indian cattle are more economical to maintain, since their food requirements are lower, particularly in regard to the nitrogenous constituents which in all countries, are the most costly to produce. The cattle of India are thus of very great potential value, but, to make the most of them, systematic breeding, disease control and scientific feeding are essential.

Typical breeds at show.—In view of the great distances to be covered and the expense involved, it was difficult to ensure satisfactory representation of all breeds at one Show, anywhere in India, but the response to the present All-India Show particularly from Indian States and one or two of the Northern Provinces, was very encouraging and visitors to this

Show had an opportunity of seeing typical representatives of most of the best breeds. Between 400 to 500 selected animals were on view mainly from North India, but representatives from the South and West were also to be seen.

It was necessary to provide food and accommodation for the animals and their attendants, throughout their stay in Delhi, and a special grant for this Show was made by the Government of India. The Rulers of Indian States and private donors were most generous, in presenting a number of very handsome trophies to be competed for at the All-India Cattle Show. It is hoped to make this an annual event, as a permanent feature of the organized assistance which is needed, throughout India, to encourage private owners in the better breeding and care of livestock. In all 30 cups were presented including one from H. E. the Viceroy for the best animal in the Show.

Temporary enclosures for about 500 cattle and camps for their attendants had been erected at the Irwin Amphi-theatre. Provision was also made for the isolation of sick animals, and for the necessary cook houses and stores from which cattle attendants were able to obtain suitable meals.

Provision against disease.—Veterinary staff was provided by the D. V. S., Punjab, and provision made for proper veterinary treatment of sick or injured animals. Every animal sent to the Show was inoculated against Rinderpest and was inspected by a veterinarian, on despatch and on arrival at Delhi, while on entering the Show yard they were required to walk through a disinfectant foot bath as a precaution against foot and mouth disease.

To obviate danger of their breaking loose, every animal was securely fastened while each bull was provided with a nose-ring and a bull staff for proper control. Arrangements were made for all cows to be milked under supervision during their stay at the Show and for sanitary disposal of the milk.

Grand cattle parade.—A parade of all the cattle took place in the main arena, in front of the stadium, on Tuesday, February 15 with a running commentary, giving a short description of each breed which was broadcast on the loud-speaker, added greately to the interest of the Show.

On Saturday, February 19, H. E. the Viceroy presented the prizes in the Cattle Section and, on the same afternoon, a parade of prize winners took place in the main arena, immediately after the usual parade of the winners in the horse classes.

In the Show yard the cattle were arranged by provinces and breeds and the names of the provinces and of the various breeds were displayed, in three languages, in front of each group. Arrangements were made to throw the cattle-yard open to the general public free of charge, on the afternoons of Wednesday and Friday, February 16 and 18.

Representative breeds.—Breeds represented in the Show were :—

Amritmahal	Jaffarabadi buffalo	Nagori
Bhagnagiri	Kankrej	Nili buffalo
Deoni	Khillari	Nimari
Dhanni	Krishna valley	Rath
Gir	Malvi	Red Sindhi
Hallikar	Mehsana buffalo	Sahiwal
Hariana	Mewati	Tharparkar
Hissar Hansi	Murrah buffalo	

The following States and Provinces co-operated in the Show.

Alwar	Dhar	Nava
Baroda	Gwalior	N. W. F. Province
Bharatpur	Hyderabad	Patiala
Bhavnagar	Jodhpur	Punjab
Bhawalpur	Junagarh	Radhanpur
Bhopal	Kalat	Sangli
Bombay	Kolhapur	Sind
Delhi	Mysore	

(*Extract from " Indian Information Series," March 1, 1938*).

POISON HAZARD IN SPRAYING FRUITS AND VEGETABLES

"Poison—Do not eat." It may be that such a label should apply to ordinarily harmless cabbage if producers use lead arsenate or other arsenical sprays to kill the insects that attack that vegetable during growth. The hazard from sprayed farm products is unfortunately not limited to the eating of spray left on vegetables. Water supplies, cattle feed, and the soil itself are contaminated; soil gradually takes up the poisons. In some regions, stock raisers have been forced to go out of business.

In an editorial, the *Journal of the American Medical Association* says : " One valley in the Pacific Northwest has received as much as 7,000,000 pounds annually of lead arsenate for the past 20 years. Therefore perhaps 50,000 tons of lead arsenate have permanently contaminated the soil. Some assume that the spray residue is washed away by rains or is

blown away by winds, but the evidence available at the present time indicates that this is not the case."

Here are three rules that the physicians feel should be enforced legally on the producer, pending the elimination of all poisonous sprays:—(1) Remove spray residues as completely as possible from apples and other such fruits, preferably by hydrochloric acid rinse. (2) Do not use skins of sprayed fruits in making cider, vinegar, jelly or other products. (3) Never use lead arsenate or other arsenical sprays on vegetables such as cabbage, cauliflower, Brussels sprouts broccoli, spinach, kale, celery, and snap beans that are eaten whole.

The housewife, in addition, is urged to wash thoroughly all fruits and vegetables that may have been sprayed (*Science Service—Scientific American, Feb. 1938.*)

MANKIND MAY STRIVE TO SAVE INSECTS

Before New Year's Day of the year 2000, man may very possibly reverse his present militant drive against insects, and actually strive to save many of the species he is now indiscriminately destroying with a grim determination. This picture of the future, quite the opposite of the conventional present concept of inevitable, implacable war to the death between man and the insects, was presented before a gathering of members of the American Association for the Advancement of Science by Dr. Edith M. Patch of the University of Maine, President of the Entomological Society of America.

This swing of the pendulum, in the relations of mankind to insects, may be expected as the result of present strenuous efforts to meet an immediate emergency. There is no question but that at least a few species of insects are so dangerous to man that they merit all the serious hostility he bestows on them. Nor is the analogy of war much overdone, when it comes to man's efforts against insects, for in this strife man employs almost as much ingenuity as he does in his military efforts to destroy his fellow-man. Poison sprays, dusts, fumes, gases, flame, scalding steam, plowed trenches, tars and other sticky traps, luring lights, X rays, electrocution, ingenious espionage, alliances that turn insect against insect—all these tricks and more are in man's armamentarium against the opposing six-legged hosts.

But a dilemma arises through the very efficiency of modern methods of insect destruction, particularly such wholesale barrage effects as the use of airplanes for laying down of poison dusts by the square mile, over

forests, cotton plantations, and mosquito-breeding marshes. These wide swathes of death sweep down not only the few insect species that are man's enemies but also the many that are his friends, or at most merely neutral and harmless.

Complaints of bee-keepers are already loud in the land. But honey-bees are only one species; there are many other wild kinds, like bumble-bees, carpenter-bees, and others that are of equal value with honey-bees as pollenizers of orchards, garden plants, and ornamental shrubs and flowers. These also are poisoned, but they die unnoticed except by professional entomologists. It may be necessary some day to set aside insect refuges, where spraying and dusting will be prohibited, to insure the transfer of pollen among the flowers we value for beauty or use, Dr. Patch suggested.

Birds, too, need insects for food, at least when they are young. It may also be necessary to insure that the trees and brushlands of their refuges shall be left in a nourishingly "buggy" state, for the sake of the hungry nestlings. And though it may sound a bit fantastic now, it is even conceivable that as present-day America has big-game sanctuaries for the benefit of the students of nature, future nature students may have to resort to "little-game" sanctuaries when they crave to swing a collecting net in the air, or grub in the ground for grubs.—(*Science Service. Scientific American, Feb. 1938.*)

PRODUCTION OF ARTIFICIAL SILK FROM COTTON

An experiment, the first of its kind in India, which may have far reaching effects on the cotton textile industry has been undertaken by the Indian Central Cotton Committee, which proposes to install a pilot plant with a view to exploring the commercial possibility of producing artificial silk from short staple cotton.

India produces enormous quantities of short staple cotton, and, if the experiment proves successful, as it is hoped to, a new use will have been found for the surplus cotton of this variety, to the great benefit of cotton growers, workers and the industry in general. A sum of Rs. 30,000 has been allotted for the experiment.

India imports annually, on an average, over 80,000,000 yards of artificial silk and over 16,000,000 pounds of artificial silk yarn. Between 70 and 80 per cent. of the yarn is used by handlooms, and the rest by power looms for mixed fabrics and fancy designs. The ever-increasing

import of these articles indicates that any prejudice with which artificial silk might have been viewed is now being overcome.

There are four processes of artificial silk-making. They are the viscose process, the cellulose acetate process, the nitro-cellulose process and the cuproi—ammonium process. Of these, the viscose and acetate processes are the two mainly employed in producing artificial silk fibre for commercial purposes. Most of the raw material used in the viscose process is wood pulp, while in the acetate process, chemical cotton is used. At present, a very large proportion of artificial silk is manufactured by the viscose process, the United States of America topping the list of producing countries, with Japan next.

Preliminary survey.—Owing to the large surplus of short staple cotton available in India the Central Cotton Committee has been interested in exploring the possibility of uses for this cotton. Excepting the theoretical possibility, nothing was known in India, and a good deal of survey and experiment was carried out at the Technological Laboratory of the Committee under the direction of Dr. Nazir Ahmed, its Director. This survey and experiment is now almost complete, and the time is considered ripe for a further step in the shape of instalment of a pilot plant for experiments which should give results more or less on an industrial scale. The type of pilot plant to be installed at the Laboratory is still under consideration, and details are now being worked out by the Director.

The fundamental defect of artificial silk, as compared to silk and cotton, is its weakness. Its tensile strength is much lower than silk, and about 50 or less per cent. than cotton according to variety. Compared to other fibres, artificial silk lacks true elasticity; it is easily stretched beyond the recovery point.

Nevertheless, artificial silk can be used without difficulty for any kind of manufacture. If, in a fabric, a high degree of durability is to be combined with softness and pliability, this can be done by uniting artificial silk with certain kinds of filaments and yarns. If such a mixed fabric is really well balanced, it may be as durable as one can wish, an example of such combination being plaited artificial silk and cotton stockings.

Production of artificial silk in the world is small compared to that of cotton, but its potentialities for expansion are great. Artificial silk is much cheaper than silk, and costs about 30 per cent. more than cotton

piecegoods. The cost, however, varies according to the country from which the fabric or yarn is imported. For instance, imports from Japan are much cheaper than from other countries. Owing to its cost, artificial silk can compete for many purposes with mercerised cotton.

Owing to the differential rates in tariff, the manufacture of artificial silk fabric in India is increasing. Most of the mills producing the fabric are located in Bombay, with a few scattered in other parts of the country. There are at present about 2,500 looms working on the fabric, all the yarn needed being imported. As the demand increases, however, the ordinary cotton textile looms, with minor alterations, can be converted to produce artificial silk.

An ornamental fibre.—Arificial silk is predominantly an ornamental fibre, and its consumption is dictated by fashion. It found an important market in the world as a material for braid-making and hosiery. It was then taken up by other classes of knitters and by dress goods weavers. As fashion has been changing, weaving factories and handlooms in India are making an increasing use of artificial silk.

In 1937, India imported 99,374,000 yards of artificial silk piecegoods, and 14,515,000 yards of artificial silk mixtures, the largest imports ever made by this country.

The import of artificial silk yarn for the same period was 17,628,884 lb., the figures for the various provinces being: Bombay, 11,420,865; Bengal, 1,813,821; Madras, 4,120,459; and Sind, 262,027.—(*Times of India.*)

TREATMENT OF COWS WITH SORE TEATS

Wire cuts and wounds on cow's teats are among the disagreeable experiences in dairying. Milking irritates a wound and often causes bleeding besides being painful. In such cases, absorbent cotton wool placed over the wound so as to make a soft pad between the milker's hand and the teat will give relief and arrest bleeding. After milking, an antiseptic ointment should be applied.—(*"Queensland Agricultural Journal—February 1938."*)

STREAMLINED PLANTS

The work of the professional plant breeder is not designed to aid the farmer alone. Everyone who produces, processes, or consumes plants and plant products is benefited in no small way by the breeder's efforts to mold superior heritage in agricultural crops. This includes everyone from the grower, whose yields are increased and income made more certain by improved varieties, to the housewife who finds better fruits and vegetables at her local market, made possible by the breeding of superior new strains. Between these two are the canners, the millers, the bakers, and the shippers, all of whom have had varieties bred to meet their specific requirements. As in the case of other lines of agricultural progress, John Public reaps the real harvest in the form of better living and lower costs.

"Streamlining" of cars may not have suggested the streamlined potato, yet such a variety is one of the chief goals of potato specialists everywhere. This streamlining is the elimination of deep eyes that cause such waste during peeling. Besides being more economical, the newer shallow-eyed varieties may be peeled with greater speed. Like the streamlining of cars, the elimination of deep eyes in potatoes is a gradual process. Our latest varieties are improvements, but still shallower eyes may be expected in later models.

Carrots used to be short chubby roots, far less attractive than the long slim beauties seen on many markets today. By careful breeding, a deeper orange colour has been developed and the core has been made more tender or practically eliminated. The modern carrot, if well grown, has as little in common with the carrot of former years as a modern streamlined car with a pre-war gas buggy.

The shape of many vegetables has been altered for the sake of beauty or to fit modern needs. A new cucumber which is uniformly eight inches long, if properly grown, is ideal for the shipper. Small Hubbard squash to fit the modren kitchen have made their appearance on some markets. Appropriately enough, the variety is called Kitchenette. It is predicted that smaller varieties of watermelons better suited to the modern refrigerator will gain favour with the housewife as a logical successor to the 30-pound monsters so common in the past.

Nature decreed that certain plants should have barbs or spines either for purposes of protection or seed dissemination. Often those individuals with the sharpest weapons of defence were the ones best able to reproduce their kind; so, through natural selection, many species

developed special means of protection prior to being cultivated by man. Just as Nature preserved individuals with the largest and sharpest weapons, man has, through many centuries of breeding, directed the process of evolution in the other direction. Wild plums and apples have thorns, yet our cultivated varieties of these fruits are entirely thornless. By selection through a number of generations, Luther Burbank once developed thornless cacti to be used as food for cattle. More recently another Californian has introduced a thornless dewberry—surely a boon to the berry picker. This streamlining for comfort has been extended to ornamentals. Many a gardener will rejoice to know that the plant breeder has taken the "barb" out of barberry, for a new "thornless" barberry was recently granted a United States Plant Patent. —(*"Scientific American" March 1938.*)

SCIENCE AND LIFE

The intellectual stimulus provided by the arrival of the delegation from the British Association for the advancement of Science reaches its climax with the opening of the Silver Jubilee Session of the Indian Science Congress at Calcutta. To mark the occasion, His Excellency the Viceroy, who by word and deed is an outstanding exponent of the application of science to life, opened the session. However greatly Bombay may regret that the Congress went to Calcutta, there is something to be said for the venue. As His Excellency explained, it was in Calcutta that the first inaugural meeting of the Association was held in 1914, and the Asiatic Society of Bengal which helped to sponsor it, fostered it, and even today aids it. The growth of interest in scientific subjects since the day the Association was founded is indicated by a membership of 109 and the reading of 31 papers at the first meeting; at this year's conference there is a membership of 1,600 and 800 papers have been presented. It is very evident, as His Excellency said, that India affords limitless opportunities for the harnessing of scientific knowledge for the betterment of mankind. It is also very evident that the first and fore-most object of applied scientific endeavour should be to better the lot of the agricultural population and to raise its standard of living. Compared with that other efforts are relatively insignificant.

The address which the late Lord Rutherford composed for the joint session as leader of the British delegation, opened with a graceful tribute to Indians of great intellectual eminence who have done so much to put this country on the scientific map. A tribute was also paid to the great scientific services of the Government of India and eminent men connected

with them in work which has no counterpart elsewhere. It is not the size or the area they cover which makes them unique, but their extension and successful working over a continent so diverse in its natural characteristics and in its people. Lord Rutherford seized upon our essential problem in writing that the research on foodstuffs has a primary claim on India's attention. There is admittedly plenty of scope, for further research, since the limits of science in this as in other fields are boundless. But the applying of knowledge is a human problem. With the best will in the world our agricultural departments may strive, yet it is not within their power so to mould men that they will use the knowledge poured out for them. In agricultural research the essential problem is not paucity of information—there is ample—but cultivating a willingness and capacity to use it.

Having described the organisation of research for industry in Britain. Lord Rutherford recognised that the methods adopted must naturally vary much in different countries. But "even in a large country like India where the resources and needs of the different provinces are very varied, it seems to me essential for efficiency that the organisation of research should be on national rather than on provincial lines. The setting up of separate research establishments for similar purposes in the various provinces cannot but lead to much "overlapping of work and waste of "effort and money.'' This is more a warning for the future than a condemnation of the past, since the need of avoiding overlapping within the limits laid down by distance and by the necessities, in cases where they exist, of demonstration have been appreciated. This, of course, follows from the fact that applied scientific research in this country falls almost entirely upon Governments. A little overlapping in research sponsored by private munificence would indeed be a healthy sign. It would at least show that weathly people are interested in the good which could come to the community from scientific work. As His Excllency the Viceroy pointed out, it is an unsatisfactory state of affairs that Governments with manifold calls on their financial resources should have to bear the main burden of research. His Excellency's suggestion that no small obligation exists on private munificence to supplement what Governments are not doing is one which ought not to go unheeded. (*Times of India.*)

LAND MORTGAGE BANKS IN C. P.—PROGRESS IN 1936-37.

The Government have issued a note describing the progress in the working of Land Mortgage Banks in the province during the year 1936-37.

At the close of the year, there were 12 banks functioning in the province. Since the close of the year three more banks have been registered with head-quarters at Khandwa, Chindwara and Khamgaon. The C.P. and Berar Provincial Co-opertive Bank at Nagpur performed the functions of the Central Land Mortgage Bank and supplied finance to the primary banks. The Government expect to terminate this arrangement as soon as the expansion of business justifies establishment of a separate central apex bank. In the year under review in accordance with the decision of the first Provincial Conference the areas of operation of the old ten banks were extended. This was considered desirable in view of the fact that only five banks were worked with profit while the rest sustained loss till the end of June 1936.

Dealing with the business of the banks, the note states that during the year the amount of loans advanced was Rs. 2,64,385 while loans applied for amounted to Rs. 6,01,570. The volume of business done during the year recorded definite improvement. The Provincial Bank advances loans to primary banks at 5 per cent and the latter to the members at 7 per cent. The effective lending rate to punctual members is 6½ per cent. With the expansion of business it is hoped that some primary banks which are now working at a loss will be self-supporting next year. The total loss these banks had to make up was Rs. 4,803. The Government after considering a proposal to make a grant to cover this deficit sanctioned a grant of Rs. 3,532. A primary bank under the old bye-law was expected to advance loans for only redemption of mortgages, repayment of debts and improvement of land and methods of cultivation. In order to make these banks more useful to the agrarian population, the bye-law has now been revised enabling the banks to advance loans for purchase of lands so as to consolidate the holdings of the borrower and to secure more efficient or economic cultivation of his lands.

DAIRY FARMING CONDITIONS

Government Inquiry.—Reliable figures have now been obtained regarding the production and consumption of milk and dairy products from seven representative areas throughout India, and these form a basis for a more complete knowledge of dairy conditions in India than has been possible hitherto.

The inquiry was initiated by the Viceroy, who suggested, shortly after his arrival, the desirability of ascertaining by direct inquiry the actual position regarding the production and consumption of milk by cultivators in typical breeding tracts with a view to obtaining an

economic background to the general breeding policy to be adopted in such areas. The Imperial Council of Agricultural Research took the matter up and undertook to finance the inquiry. The chosen supervisors were given a course of training in Delhi, to fit them to direct the inquiry, and arrangements were made with the provincial authorities concerned to render assistance, which was freely rendered and proved very valuable during the course of the inquiry. This inquiry was undertaken during the cold weather of 1936-37 and occupied five months. It was so thoroughly carried out that, at only small extra expense, exact and most important information was obtained, which did not previously exist, as to village practice in rearing cattle, besides tne important particulars for which the inquiry was instituted.

Areas selected.--The areas chosen for the inquiry were (1) the Hariana tract (Delhi Gurgaon-Rohtak); (2) the Kosi tract in the United Provinces; (3) the Kankraj tract in Bombay Presidency; (4) the Ongole tract in Madras Presidency; (5) the Malvi area in the Central Provinces; (6) the Montgomery area in the Punjab and (7) the Deltaic area in Bihar.

The report was considered by the Advisory Board of the Imperial Council of Agricultural Research at its meeting in November and is understood to have proved a most important document, in that it not only supplies the information already mentioned but also reveals that most careful investigation has shown that in some areas certain facts elicited were contrary to the general view.

One such discovery is that country butter is definitely an important constituent of the diet of the people in some areas, in some cases almost entirely displacing *ghee*.

The average figures obtained by this inquiry are in close agreement with those of two earlier surveys conducted by Major-General Sir John Megaw for the whole of India and that conducted by Dr. D. C. Wilson into the food habits of 30 urban and 30 rural families in the Sialkot District.

The report is now in the Press and will be issued shortly.—(*Times of India.*)

College Notes

We are extremely glad to announce that the Executive Council of the Nagpur University has declared Rao Sahib D. V. Bal, L. Ag., Agricultural Chemist to Government and Professor of Agricultural Chemistry, College of Agriculture, Nagpur, as eligible for admission to the Degree of Master of Agriculture with Honours of the University.

Annual Promotion Examinations Results

1937–38

The following is a list of students who have been promoted to the next higher class :—

First Year Class

K. S. Krishna Rao.	W. P. Sole.	S. L. Goil.
Babulal Nema.	P. V. Deo.	V. R. Temarnikar.
B. C. Pradhan.	R. N. Bhargava.	R.S. Mehta.
S. L. Gadwe.	S. S. Phadnaik.	G. G. Kurde.
R. P. Jyotishi.	A. D. Kane.	S. L. Shrivastava.
D. K. Sohoni.	K. K. Bhargava.	Mohanlal Saxena
M. K. Oke.	S. D. Deshmukh.	P. S. Thakur.
M. V. Lele.	K. P. Lele.	M. D. Khaparde.
L. N. Malavaiya.	V. V. Gokhale.	S. L. Patni.
S. A. Hussain.	R. G. Limsay.	B. B. Bannerji.
H. S. Dabir.	M. N. Gadre.	D. S. Kshirasagar.
M. S. Puranik.	K. S. Dave.	Thakur Inder Raj Singh.
V. S. Barker.	N. T. Jagdale.	B. S. Gokhale.
D. P. Keote.	L. A. Labhe.	Lila Paranjpe (Miss).
S. K. Shingarey.	W. D. Sawargoankar.	

Third Year Class

M. V. Gokhale.	S. S. Tomar.	B. H. Tembhre
M. C. Gangrade.	N. B. Gupta.	P. K. Mukerji.
D. G. Dakshinidas.	G. R. Tatwavadi.	H. S. Thakur.
N. Y. Karkarey.	B. S. Shukla.	Asghar Ali Raja.
B. G. Ghawaghawe.	Y. K. Saoji.	V. D. Deshpande.
D. C. Jain.	M. D. Patil.	

NAGPUR UNIVERSITY

The following examinees who presented themselves at the Intermediate (Agriculture) Examination of 1938 are declared to be successful :—

First Division. (*In order of merit*).

1. G. R. Shirpurkar.**
2. V. W. Mandlekar.
3. V. W. Deshpande.
4. S. K. Gangrade.

** Awarded the Sir Arthur Blennerhassett Memorial Medal.

Second Division

Abdul Wali.	J. P. Nema.	R. K. Shukla.
B. W. Lakhe	K. G. Bhide.	R. N. Tiwari.
B. T. Wankhade	K. R. Sahasrabudhe.	S. A. Joshi.
C. M. Kekre.	M. W. Khankhoje.	S. N. Sakalley.
G. P. Choubey.	R. S. Kachwaha.	V. P. Avadhoot.
H. N. Soni.	R. C. Deshmukh.	Y. V. Salpekar.

Third Division

S. P. Chitnavis W. W. Purohit.

Pass Division

A. N. Rokde.	M. R. Banpurkar.	Y. M. Mokashi.
D. R. Vaidya.	M. J. Khare.	*(Under Para 12 Ordinance 17.)*
G. U. Patanker.	N. P. Shrivastava.	B. H. Tembhre.
G. D. Dalal.	P. N. Patey.	B. S. Shukla.
K. J. Deshpande.	R. V. Gumasta.	H. S. Thakur.
K. A. Bhandarkar.	T. V. Rama Iyer.	H. N. Das
M. V. Kothekar.	W. G. Naseri.	N. B. Gupta.

The following are declared eligible to appear only in the subject noted against each :—

S. N. Joshi (Agriculture); R. B. Jalit and V. R. Deshmukh (English)

The following examinees who presented themselves at the B. Ag. Examination of 1938 are declared to be successful :—

First Division

W. B. Date. (Awarded Sir Arthur Blennerhassett Memorial Medal and Chakradeo Memorial Medal.)

Second Division

B. L. Choudhri.	M. S. Kiledar.
G. S. Bhagwat.	M. G. Kamkholkar.
G. R. Shombekar.	M. A. Kolkhede.
K. U. Tathode.	P. M. Shrivastava.
M. K. Reddy.	V. T. Tankasale.

Third Division

M. Kesava Das. B. P. Upadhyaya.

Pass Division

T. N. Supe. H. A. Kaiyumi. Mohommad Nasiruddin.

The following are declared eligible to appear only in the subject noted against each :—

K. R. P. Nair and N. T. Saoji—Agricultural Chemistry.

T. M. Koyal—Botany and Plant Pathology.

V. S. Kulkarni—Agriculture

Departmental Notifications

RETIREMENTS

Government has sanctioned the retirements from service of (1) Mr. Kalka Prasad Shrivastava, E. A. D. I/c of the office of the Second Economic Botanist to Govt. C. P. and Professor of Botany, College of Agriculture, Nagpur from 9th May 1938,

and (2) Mr. Govind Prasad E. A. D. Northern Circle from 1st July 1938.

Mr. B. D. Siddique, Agricultural Asst. Drug retired from service on 1st April 1938.

Mr. L. N. Dubey, E. A. D. Chhindwara, retired from service on 16th April 1938.

TRANSFERS

NAME OF OFFICER	FROM	TO
Mr. N. K. Pendse.	Leave.	A. A. Amraoti.
,, N. G. Shirpurkar.	A. A. Amraoti.	A. A. Dharni.
,, P. D. Nair.	A. D. A. Nagpur.	Offg. D. D. A. Economics and Marketing.
,, D. L. Janoria.	F. S. Akola.	Offg. E. A. D. Amraoti.
,, D. Y. Bhond.	Cotton Botanist Section.	F. S. Akola.
,, J. S. Gurjar.	Foreign Service under I. C. C. C.	E. A. D. office of Director of Agriculture, Nagpur.
,, M. V. Jamkhandikar.	A. A. (Western Circle)	Offg. E. A. D. Hoshangabad.
,, Dhannalal.	Asst. Lecturer, College of Agriculture, Nagpur.	In charge of Current Duties of Officer, Government Gardens, Nagpur.
,, G. W. Pitale.		Asst. Overseer Maharaj-Bagh Gardens.

LEAVE

Mr. R. H. Hill.	D. D. A. Economics and Marketing.	8 months from 18-3-38.
,, Govind Prasad.	E. A. D. Northern Circle.	Leave up to 1st July 1938 (preparatory to retirement)
,, N. G. Sule.	E. A. D. Amraoti.	3 months from date of relief
,, S. G. Igotpurikar.	Superintendent Govt. Gardens, Pachmarhi.	6 months from 7-4-38 (preparatory to retirement)
,, Mani Ram Singh Barker.	E. A. D. Hoshangabad.	2 months from date of relief.
,, J. F. Dastur.	Mycologist to Govt.	2 months 6 days from 25-4-38.
,, G. V. Bakre.	A. A. Dharni.	2 months from date of relief.

Date of issue.	Date of issue.	Date of issue.
2.1.49		
12.8.55		
19.3.58		
26.10.66		